LAND USE SAFETY CONSIDERATIONS STUDY

SPECIAL ACTIVATION PRECINCT

WILLIAMTOWN

FINAL

DEPARTMENT OF PLANNING AND ENVIRONMENT

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ABBREVIATIONS

AN	Ammonium Nitrate
AS	Australian Standard
BESS	Battery Energy Storage System
BLEVE	Boiling Liquid Expanding Vapour Explosion
DG	Dangerous Good(s)
DPE	Department of Planning and Environment
ERPG	Emergency Response Planning Guideline
ERG	Emergency Response Guidebook
HIPAP	Hazardous Industry Planning Advisory Paper
kPa	kilopascal (absolute)
LGA	Local Government Area
LPG	Liquefied Petroleum Gas
MHF	Major Hazard Facility
MIPA	Monoisopropyl Amine
NSW	New South Wales
PHA	Preliminary Hazard Analysis
PV	Photo Voltaic
RAAF	Royal Australian Air Force
SAP	Special Activation Precinct
SDS	Safety Data Sheet
SEPP	State Environmental Planning Policy
WHS	Work, Health and Safety

TERMINOLOGY

Term	Definition
Active land use	Sporting complexes and active open space
Buffer Zone	An area surrounding a facility or between areas designated for certain types of developments to minimise the potential for land use safety conflicts. Beneficial activities, typically with low density populations, intermittent use or lower risk, can occur in buffer zones to minimise sterilisation of land.
Case Studies	A set of industries selected for assessment in the study. The industries were agreed in consultation with DPE and are used as the basis to assess the proposed SAP layout and zoning.
Commercial land use	Commercial developments including retail centres, offices and entertainment
General industries	As set of industries selected for high level consideration in the study. The industries were identified at a higher level than the case studies and were used to identify additional considerations in the study.
Residential land use	Residential, hotels, motels, tourist resorts
Sensitive Land use	Hospitals, schools, child-care facilities, old age housing
Separation Distances	Separation distances are used in this report to describe the distance between a source of risk and a receptor. They are a function of the configuration of the SAP and surrounding land uses.
The HIPAP 10 performance objective to 'protect residential amenity and health'	In the context of risk to people, amenity is concerned with nuisance type issues such as noise and odour. Amenity is not assessed in this study and 'health' is taken to mean safety due to acute effects of incidents for potentially hazardous facilities.

1. EXECUTIVE SUMMARY

1.1. Background

The New South Wales (NSW) Government is developing a planning framework to support the implementation of Special Activation Precincts (SAPs) in regional locations. The purpose of a SAP is to facilitate job creation and economic development in designated areas of regional NSW through infrastructure investment and fast-tracked, streamlined planning.

The Department of Planning and Environment (DPE) is preparing the Special Activation Master Plan (the Master Plan) for a SAP at Williamtown (the Williamtown SAP) and has commissioned this study to assess the land use safety considerations that will form an input to the Master Plan.

The study has been conducted on the basis that the current land use safety policy [State Environmental Planning Policy (SEPP) No. 33 (SEPP33) – Hazardous and Offensive Development], supported by the NSW Hazardous Industries Planning Advisory Papers (HIPAPs), applies to development applications in the SAP.

The high level objective of this study is to support development of a SAP which minimises the potential for land use safety conflict as the Williamtown SAP is developed. This is achieved by establishing a planning framework and defining preferred locations for developments, identifying development types that are not appropriate and incorporating features such as buffer zones into the configuration of the SAP.

The study addresses land use safety planning matters only, i.e. acute effects from potentially hazardous industries due to loss of containment or control of hazardous materials that may lead to fires, explosions or toxic releases. Potentially offensive industries will be managed under the existing Environmental Projection License framework as detailed in SEPP33.

The proposed SAP configuration was assessed against criteria developed from Hazardous Industry Planning Advisory Paper No.10: Land Use Safety Planning (HIPAP 10) to determine the potential for developments in the SAP to result in land use safety conflict. The following criteria were selected:

- A performance objective to protect residential safety[1]
- Individual risk
- Societal risk.

The basis of the assessment was:

- the NSW planning framework for potentially hazardous facilities

[1] Derived from the HIPAP 10 performance objective to protect residential amenity and health.

- the proposed SAP configuration
- a set of potentially hazardous development options, referred to as 'case studies' (Table 2.1)
- a set of potentially hazardous general industries (Table 2.2)
- existing land uses (Figure 4.1 and Figure 4.2).

The assessment is qualitative with limited quantification of consequences taken from publicly available sources to support the assessment. The level of assessment reflects the uncertainty of the nature and scale of developments that may be proposed for the SAP.

1.2. Summary of assessment findings

A hazard and risk assessment has been completed for the Williamtown SAP against a set of case studies, general industries and existing land use. The study:

- identifies potential land use safety conflicts using a set of case studies and risk criteria from HIPAP 10.
- identifies preferred locations for potentially hazardous developments.
- proposes buffer distances based on typical inventories and land use safety considerations along with proposed beneficial activities that may be appropriate in the buffers.
- assesses types of development that may not be appropriate for the SAP.
- identifies additional areas for consideration in the Master Plan.

The overall findings of the study are:

- SEPP 33 and the requirement to complete a Preliminary Hazard Analysis (PHA) for potentially hazardous industries is an appropriate framework for managing land use safety conflict.
- the preferred location for higher risk (potentially hazardous industries) users is the western catchment, with a transition to lower risk industries in the east and north of the SAP.
- there are residences in the SAP. Controls will be required in the Master Plan to manage the transition from residential to employment. The timing of any change will be dependent on the staging of the SAP development taking into account the need to manage risk levels at residences.
- there are existing residences adjacent to the SAP boundary. To manage land use safety conflict with existing residences outside the SAP the following controls are proposed:

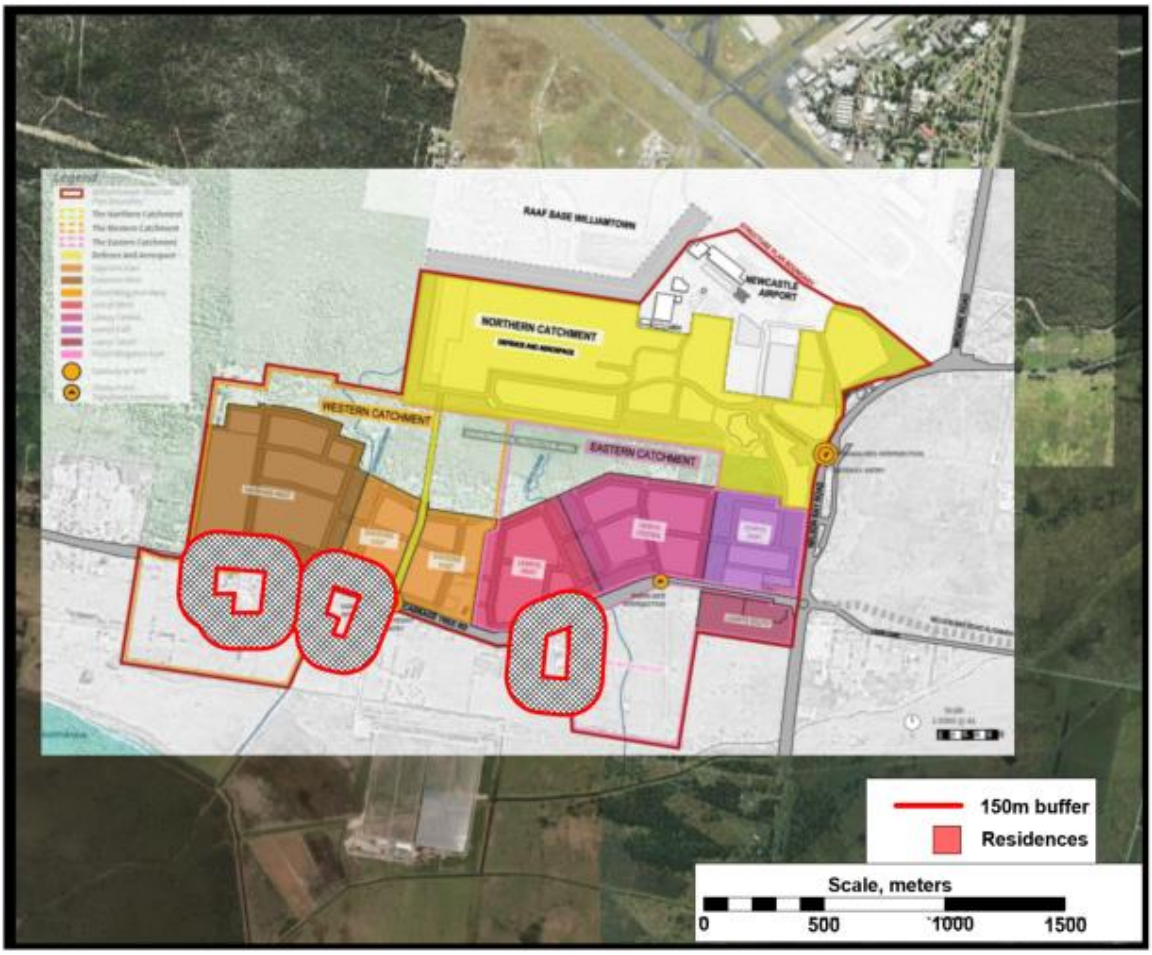
- 150m buffer zone around existing residences would limit the potential for land use safety conflict with the potentially hazardous developments assessed in this study for all but the largest toxic releases (Figure 1.1).
- buffer zones to manage the consequences of toxic spills or toxic products of combustion could extend up to 900m resulting in unnecessary limitations on developments in the SAP. Given the small scale of the SAP and the existing residential developments buffer zones are unlikely to be practicable. Such risks are best managed through the risk-based SEPP 33 process.

- Notwithstanding the potentially permissibility under SEP33, based on the relatively small area available for development in the SAP and the proximity of existing and proposed populations, developments with the following hazardous materials and activities are not considered appropriate for the SAP as they may preclude development more aligned to the proposed character of the SAP.
  - any facility that exceeds the 10% of the Major Hazard Facility (MHF) threshold as detailed in Schedule 15 of the NSW Work, Health and Safety (WHS) regulations.
  - handling or storage of Ammonium Nitrate (AN) (such as fertiliser manufacturer) in quantities that exceed the SEPP 33 screening threshold.
  - handling or storage of ammonia (such as fertiliser manufacturer or food/abattoir with ammonia refrigeration circuit) in quantities that exceed SEPP 33 screening thresholds
  - Liquefied Petroleum Gas (LPG) storage in above ground tanks that exceed the SEPP 33 screening threshold. Storage in mounded or buried tanks will minimise the consequences of the largest events and should be assessed in a PHA.
  - facilities that handle and/or store toxic substances (Class 6) that exceed the SEPP 33 screening threshold (such as freight facility with toxic substances).
  - facilities that import liquified petroleum product by pipeline and store in above ground atmospheric tanks are not appropriate due to the potential for overfill and subsequent large vapour cloud explosion.
  - storage of hydrogen in bulk, for example liquid hydrogen for commercial vehicle refuelling or hydrogen/ammonia conversion facilities, is likely to result in land use safety conflict due to the relatively small scale of the SAP. Hydrogen generated for immediate use (e.g. vehicle refuelling) is unlikely to result in land use safety conflict.
- a high-pressure gas pipeline runs along the eastern boundary of the SAP. It is recommended that DPE consult with Jemena (the pipeline operator) to determine the requirements for buffer zones or any implications of rezoning or population intensification in the vicinity of the pipeline. The consent authority should notify the pipeline operator of any development applications in Learys East, Learys South and

the eastern section of the northern catchment and ensure the safety risks from the pipeline or safety risks to the pipeline during construction and occupancy of the development are taken into consideration.

- development controls will be required to manage development in the environmental protection area to limit the potential for commercial activities that result in an increase in population in the area (for example café or sporting fields).
- development controls will be required to manage risks that relate to research and development activities due to:
  - risks and required controls not well understood and activities that may not fall under a standard approach.
  - risks associated with scaling up facilities that may not be understood at the initial development application stage.
  - activities may be perceived to be temporary in nature and hence not require development approval.

Figure 1.1: 150m buffer zone



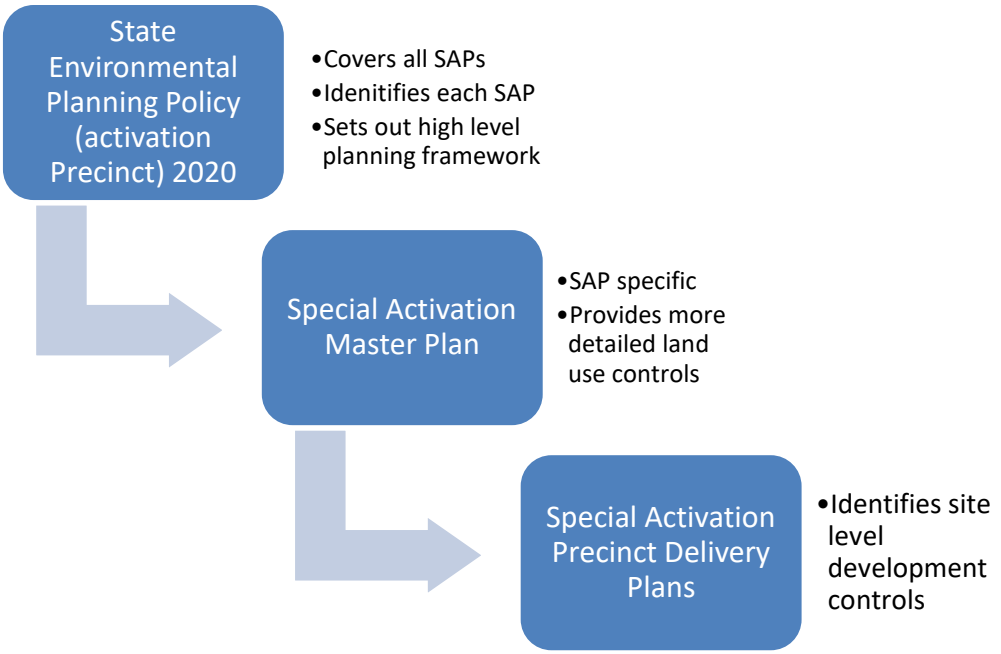
2. INTRODUCTION

2.1. Background

The NSW Government is developing a planning framework to support the implementation of SAPs in regional locations. The purpose of a SAP is to facilitate job creation and economic development in designated areas of regional NSW through infrastructure investment and fast-tracked, streamlined planning.

The SAP planning framework comprises three levels as shown in Figure 2.1.

Figure 2.1: SAP planning framework



The Department of Planning and Environment (DPE) is currently preparing the Special Activation Master Plan (the Master Plan) for a SAP at Williamtown (the Williamtown SAP).

The proposed Williamtown SAP has the potential to accommodate a wide range of developments including those that may be determined as *potentially hazardous activities* under SEPP 33. DPE's aim is to ensure that the land use planning safety issues associated with potentially hazardous developments are assessed during the planning phase with appropriate controls incorporated into the Williamtown SAP Master Plan.

In the context of providing a fast tracked, streamlined planning process, this study has been conducted on the basis that:

- the current land use safety policy (SEPP 33 and supporting processes embodied in the NSW HIPAPs) will be applied in the SAP.
- a facility that exceeded 10% of the MHF threshold would not be considered eligible for any simplified or streamlined planning process.

The intention of the study is to support development of a SAP that minimises the potential for land use safety conflict during the development application and assessment process for facilities that are potentially hazardous but are not required to notify as a potential MHFs.

2.2. Strategic land use safety planning

Strategic land use planning balances the threats and opportunities associated with developing land to maximise utility whilst managing land use conflicts. To achieve this balance strategic planning assesses a range of factors and issues including, but not limited to, threats to the natural environment, noise and air pollution.

Strategic land use **safety** planning provides the opportunity to put in place controls that eliminate or minimise land use safety conflicts though a combination of separation distances, buffer zones and limits on certain types of industries, activities and quantities of hazardous materials.

This study is limited to the consideration of acute risks to people living or working in the SAP and surrounding areas. Other factors (e.g. environmental) may result in controls that are over and above any requirements identified in this study.

2.3. Study objectives

The objectives of the study were developed in consultation with the DPE and are as follows:

1. Develop a SAP level hazard and risk assessment to inform the Master Plan. The assessment will include identification of existing operations and facilities within the SAP investigation area.
2. Identify a suitable planning framework to manage land use safety conflict.
3. Identify whether there are potential land use safety conflicts based upon the likely hazards and risks from existing and future developments. Future developments are defined in this document as a set of case studies. The case studies were agreed with the DPE and are detailed in Section A1.
4. Identify the preferred location for the proposed case studies within the SAP with minimal or avoidance of land use safety conflicts.
5. Identify recommendations based on the typical risk profile for the case studies in terms of maximum hazardous material quantities, suitable locations and recommended buffers.
6. Identify the approximate setback distances from the case studies to industrial land uses, commercial land uses, residential land uses and sensitive land uses, in accordance with the principles of strategic planning and criteria in HIPAP 10.
7. Identify developments that are not appropriate for the SAP, in the context of land use safety planning.

8. Identify recommendations for performance-based criteria for the proposed uses in the Master Plan (i.e. setback distances, co-location of facilities, processing thresholds and storage capacities) for the agreed case studies.

2.4. Williamtown SAP

The Williamtown SAP investigation area is located to the south of Newcastle Airport covering an area of approximately 332 hectares (Figure 2.2). A smaller proportion was chosen for the SAP as indicated by the Williamtown SAP boundary which includes the catchments shown in Figure 2.3. The scope of this study covers development within the Williamtown SAP boundary.

Figure 2.2: Williamtown SAP – Investigation area

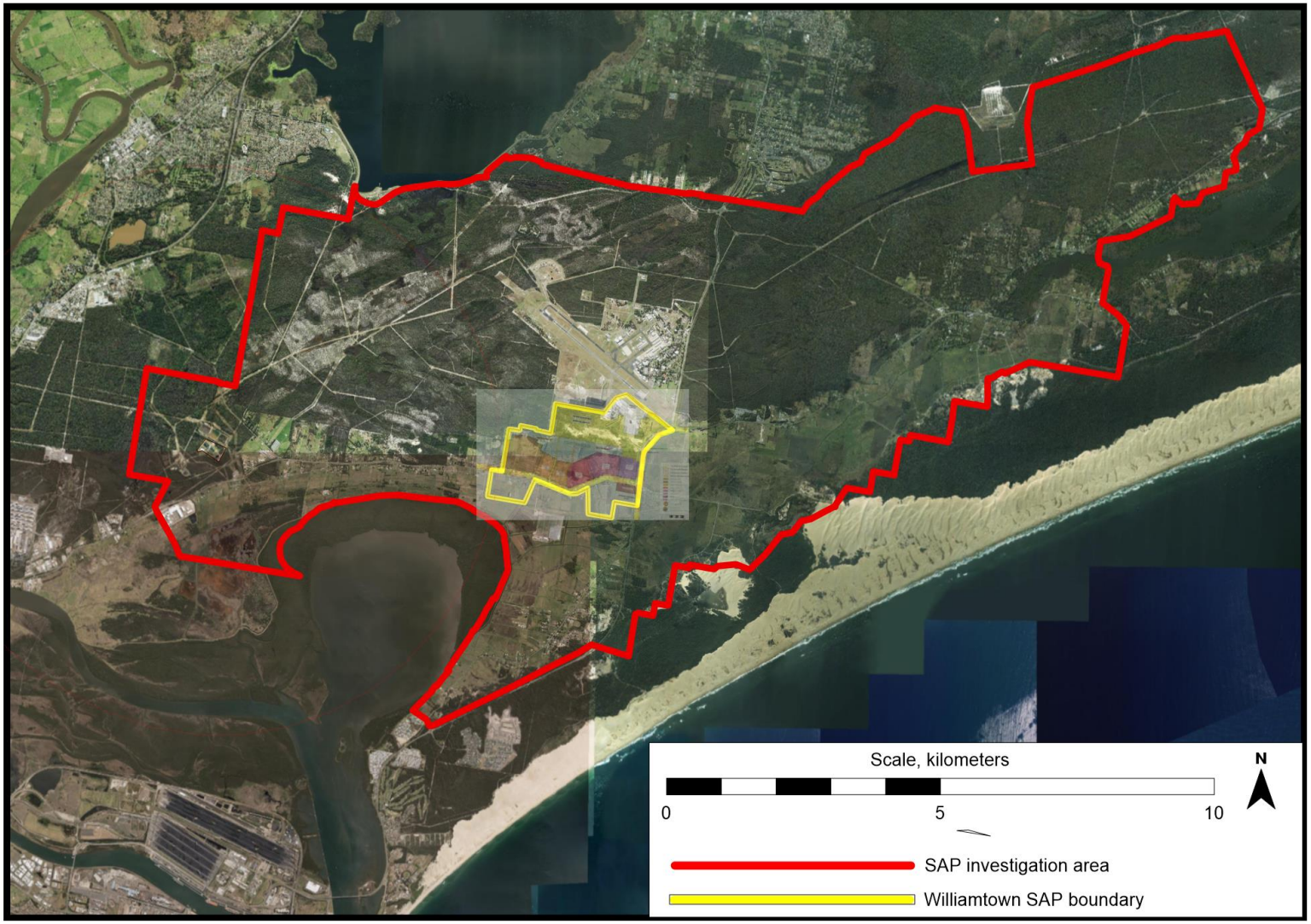
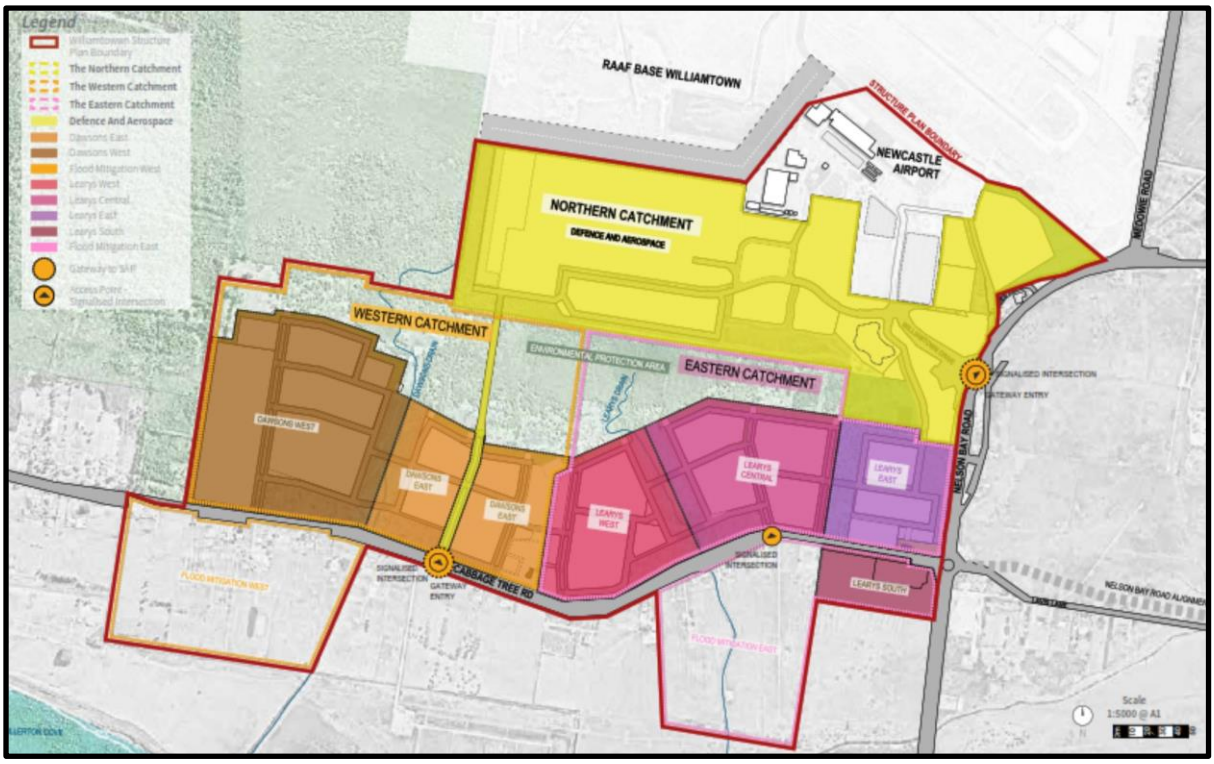


Figure 2.3: Williamtown SAP



2.5. Study basis

The purpose of this assessment is to provide input to a SAP framework that avoids or minimises land use safety conflicts. To provide a basis for the assessment a set of case studies (Table 2.1) and three general industries (Table 2.2) were defined to represent potentially hazardous facilities that could be developed in the SAP.

The case studies were assessed to inform potential land use safety conflicts, buffer zones, locating facilities in defined areas, processing thresholds and storage capacities.

For general industries, the assessment identified the key hazards and risks for consideration in land use safety planning.

Based on the available area, developments that require large lot sizes, such as farming, horticulture or large scale solar have been excluded from the study.

There is no rail line in the SAP and as such a rail/road freight intermodal has not been assessed in the study.

Table 2.1: Agreed case studies

No	Industry	Details/thresholds
1	Breweries and distilleries	Breweries or distilleries producing alcohol or alcoholic products that have an intended production capacity of more than 30 tonnes per day or 10,000 tonnes per year.
2	Ceramic and glass industries	Ceramic or glass industries (being industries that manufacture bricks, tiles, pipes, pottery, ceramics, refractories or glass by means of a firing process)— (a) that have an intended production capacity of more than 150 tonnes per day or 30,000 tonnes per year.
3	Chemical industries and works	Petrochemical industries that manufacture petrochemicals or petrochemical products in quantities of more than 2,000 tonnes per year.
4	Chemical industries and works (farm inputs)	Pesticide, fungicide, herbicide, rodenticide, nematocide, miticide, fumigant or related products industries: (i) that use or produce materials classified as poisonous in the Australian Dangerous Goods Code, or (ii) that manufacture products in quantities (excluding simple blending) of more than 2,000 tonnes per year
5	Chemical industries and works	(f) plastics industries— (i) that manufacture more than 2,000 tonnes per year of synthetic plastic resins, or (ii) that reprocess more than 5,000 tonnes of plastics per year otherwise than by a simple melting and reforming process, (g) rubber industries or works— (i) that manufacture more than 2,000 tonnes per year of synthetic rubber, or (ii) that manufacture, retread or recycle more than 5,000 tonnes per year of rubber products or rubber tyres, or (iii) that dump or store (otherwise than in a building) more than 10 tonnes of used rubber tyres, or
6	Petroleum works	(e) that store petroleum and natural gas products with an intended storage capacity in excess of— (i) 200 tonnes for liquefied gases, or (ii) 2,000 tonnes of any petroleum products
7	Hydrogen generation or Battery Energy Storage System (BESS)	Small scale hydrogen generation and storage facility, or BESS.

Table 2.2: General industries for consideration

No	Industry
11	Fertiliser productions (such as ammonia or AN)
12	Bitumen production
13	Food processing (e.g. abattoir or packaging)

2.6. Planning guidelines

The study was undertaken in the context of the documents in Table 2.3.

Table 2.3: Study reference documents

Ref	Document	Level	Use in study
[1]	DPE HIPAP No. 10 – Land Use Safety Planning	Primary	Established the principles, framework and criteria for the assessment
[2]	SEPP 33 Hazardous and Offensive Development and the supporting application guidelines (Applying SEPP 33)	Primary	Established the threshold for potentially hazardous facilities
[3]	DPE HIPAP No. 4 – Risk Criteria for Land Use Planning	Supporting	Provides land use safety criteria
[4]	NSW Work Health and Safety Act (and supporting regulation)	Supporting	Supported guidance on threshold quantities for an MHF
[5]	Australian Emergency Response Guide Book 2021.	Supporting	Provides extent of evacuation and distances requiring protection.
[6]	Infrastructure SEPP	Supporting	Developments adjacent to pipelines

2.7. Limitations

The limitations in Table 2.4 apply to the study.

Table 2.4: Limitations

Item	Issue	Remarks
1	Level of assessment	The study is a qualitative assessment of potential land use conflicts and preferred locations for typical generic developments.
2	Reliance on existing studies and experience	The assessment is based on existing studies and experience from assessments. Existing studies have not been verified for accuracy and completeness and study basis may not match the proposed case studies. The existing studies are indicative only.
3	Application of results	The output of the study will be guidance on land use considerations in the SAP. The study results will not be appropriate for determining if a specific development proposal meets the NSW land use safety planning criteria.
4	Potentially offensive developments	The study assessed land use safety considerations only. The study excludes potentially offensive and environmental considerations.
5	Dangerous Goods (DGs) Transport Route Selection	The study has not assessed transport (road or rail) of DGs to and from the SAP.

Item	Issue	Remarks
6	Threshold quantities	The assessment covers potentially hazardous facilities (under SEPP 33) that do not reach 10% of the MHF threshold.
7	Royal Australian Air Force (RAAF) base and activities	The study assumes that the hazards associated with the existing RAAF base are understood, controlled and have been accepted in the context of land use safety planning. The study has not assessed consequences from the existing RAAF base on the SAP.

3. CRITERIA

3.1. Background

The assessment of risk requires a set of criteria against which decisions can be measured and judged. HIPAP 10 provides guidance on the principles of strategic land use safety planning, performance objectives and selecting criteria for land use safety studies. As the SAP Master Plan is concerned with strategic planning, the approach and criteria in HIPAP 10 are appropriate for this assessment.

3.2. HIPAP 10 Land Use Safety Planning

3.2.1. General

HIPAP 10 describes land use safety planning as a mechanism for dealing with actual or potential conflicts between sources of risk, such as potentially hazardous industrial developments and surrounding land uses. The document focuses on the impacts of industrial hazards in particular those arising from loss of containment of hazardous materials leading to fires, explosions and toxic releases.

The aim of strategic land use safety planning is the avoidance or minimisation of land use conflicts by considering issues as early as possible in the planning cycle, with four factors that should be taken into consideration:

1. permissibility of the proposed land use;
2. the need to avoid environmentally sensitive areas[2];
3. compatibility with nearby land uses; and
4. results of initial site investigations as to the fundamental suitability of the site.

This strategic land use consideration study focusses on avoiding impacts to land uses and the compatibility of nearby land uses, in the context of acute safety impacts to people.

The factors are supported by four general principles:

- the avoidance of avoidable risks;
- the risk from a major hazard should be reduced wherever practicable, even where the likelihood of exposure is low;
- the effects of significant events should, wherever possible, be contained within the site boundary; and
- where the risk from an existing installation is already high, further development should not pose incremental risk.

[2] From a land use safety planning perspective as per HIPAP 10 ‘environmentally sensitive’ includes areas close to sensitive land uses such as schools, nursing homes and hospitals.

3.2.2. Strategic land use planning criteria

HIPAP 10 provides guidance on integrating land use safety considerations into a strategic plan and land use safety performance objectives. Table 3.1 summarises how the HIPAP 10 factors are taken into consideration in this study and summarises how the factors are used to determine land use safety conflicts and separation distances.

The HIPAP 10 performance objective to 'protect residential amenity and health' was used to frame the assessment of impact at residential and sensitive land uses. In the context of risk to people, amenity is concerned with nuisance type issues such as noise and odour. Amenity is not assessed in this study and 'health' is taken to mean safety due to acute effects of incidents from potentially hazardous facilities.

Table 3.1: HIPAP 10 strategic land use planning factors

Factor	HIPAP 10 consideration	Implementation in Land Use Safety Considerations study
Permissibility of land use	Determine which types of development are permissible in an area.	The basis of this assessment is that the case studies (potentially hazardous facilities) may be located in any areas of the SAP and SEPP 33 applies as prerequisite of approval. There is an assessment and discussion on the implications of locating certain case studies in other zones in the study assuming they are permissible.
Avoid environmentally sensitive areas	Lists examples of environmentally sensitive areas which includes areas close to sensitive land uses such as schools, nursing homes and hospitals.	The study assesses the potential impact on schools, nursing homes and hospitals.
Compatibility with land uses	Provision of buffer zones including the identification of beneficial land uses which can form a buffer between potentially hazardous industries and sensitive land uses such as residential areas.	The study assesses the need for and extent of buffer zones to sensitive land uses, including beneficial use of land in buffer zones.
Initial site investigation	The purpose of the initial site investigation is to provide an early indication of the suitability of a proposed site.	Given the generic nature of the case studies under consideration and the lack of any formal development applications, the site level assessment is limited to likely compliance with risk criteria.

Table 3.2: HIPAP 10 performance objective in the context of acute risk to people

Land Use	Performance Objective	Factor for determining appropriate separation distances in HIPAP 10	Adopted in Land Use Safety Considerations study to assess safety?
Residential areas, hospitals or schools	Protect residential safety	What is the likelihood of the performance objective being achieved by the mitigation measures alone?	Assessment based on the quantity of DGs on site. Focus on consequences impacts given the uncertainty in controls and hence likelihood.
		What is the likelihood of the mitigation measure failing?	
		What is the likelihood of an incident which will result in a failure to meet the performance objectives?	
		What back up mitigation measures are available?	
		What is the likely geographic extent of the impacts if mitigation measures fail or an incident occurs?	Yes
		What separation distances are required to achieve the performance objective: • Under normal operational and mitigation performance conditions • If mitigation measures fail or an incident occurs.	Yes

3.2.3. Consequence criteria

The consequences of incidents from potentially hazardous facilities were assessed against the criteria in Table 3.3. Where quantitative data was available for the case studies, the results were used to inform the assessment.

Table 3.3: Consequence criteria

Impact	Qualitative criteria	Quantitative criteria
Heat radiation	Heat radiation reaches target	Incident heat flux radiation: - at a residential and sensitive use areas does not exceed 4.7kW/m^2, - at neighbouring hazardous installation does not exceed 23kW/m^2 (escalation potential).
Explosion overpressure	Explosion overpressure of concern reaches target	Incident explosion overpressure at a residential and sensitive use areas should not exceed 7kPa. Incident explosion overpressure at 21kPa at industrial facility to cause escalation.
Toxic exposure	Emergency response guideline distances met	Toxic concentrations in residential and sensitive areas should not exceed a level which would be seriously injurious to sensitive members of the community following a relatively short period of exposure [Emergency Response Planning Guideline (ERPG 2) or 1% fatality level].

3.2.4. Individual and societal risk criteria

Individual and societal risk criteria are presented in HIPAP 10.

Given the uncertainty in the nature, scale and controls and the number of proposed developments individual risk societal risk was not assessed quantitatively. Developments were qualitatively assessed for their potential to result in individual risk or societal risk associated with populated areas with the potential to result in land use safety conflict.

3.3. SEPP 33

The NSW guide on applying SEPP 33 provides criteria for determining if a development is potentially hazardous. The criteria are based on the quantity and classification of DGs and in some cases the distance from the DG to the site boundary.

Where information is available, the quantity of DGs by class for a typical development type were used to inform a qualitative assessment of the potential scale and nature of risk associated with a development.

3.4. Uncertainty

A key aspect of this assessment is the uncertainty in the nature, scale, number and location of developments.

The criteria were used to frame a discussion on the zoning and applicability of the SAP catchments for different types of development in the context of the existing land uses, to provide a view of the types of development that may be considered in each catchment and to inform general development controls.

4. STUDY BASIS

4.1. Overview

The DPE, in conjunction with the local council has developed a plan for the Williamtown SAP including the location of catchments for prescribed activities. The key features of the Williamtown SAP in the context of land use safety planning are described in this section.

4.2. SAP configuration and features

The Williamtown SAP is divided into catchments as described in Table 4.1, with key features described in Table 4.2.

Wind and weather data was obtained for Williamtown for a five-year period from Willy Weather (Ref. [7]). This shows the prevailing wind direction is from the northwest and majority (~35%) at a wind speed ranging from 1 to 13 km/h.

Table 4.1: SAP features

Catchment	HIPAP 10 land use	Description	Considerations and constraints
Newcastle Airport	Commercial	Covers existing Newcastle Airport	The area is existing, any development in this area is assumed to be compatible with the current zoning including storage and handling of jet fuel.
Defence and Aerospace	Industrial	Located in the north of the SAP adjacent to Newcastle Airport.	The basis for the study is the area will be used for industrial and commercial activities.
Environmental protection	N/A	Locate in the centre of the SAP area.	The basis of the study is the area is under environmental protection. The guidance from HIPAP 10 suggests industrial developments should not be sited in proximity where consequences and likelihood of impacts may threaten long term viability of the ecosystem or the likelihood is now substantially lower than the background level of threat to the ecosystem.
Western Catchment	Industrial		The assessment basis for the study is the area may be used for industrial activities that may include potentially hazardous facilities.
Eastern Catchment	Industrial		The assessment basis for the study is the area may be used for industrial activities that may include potentially hazardous facilities.

Table 4.2: SAP features

Feature	Commentary
Nelson Bay Road	Provides road access to the eastern side of the SAP.
Cabbage Tree Road	Provides road access to the southern side of the SAP.

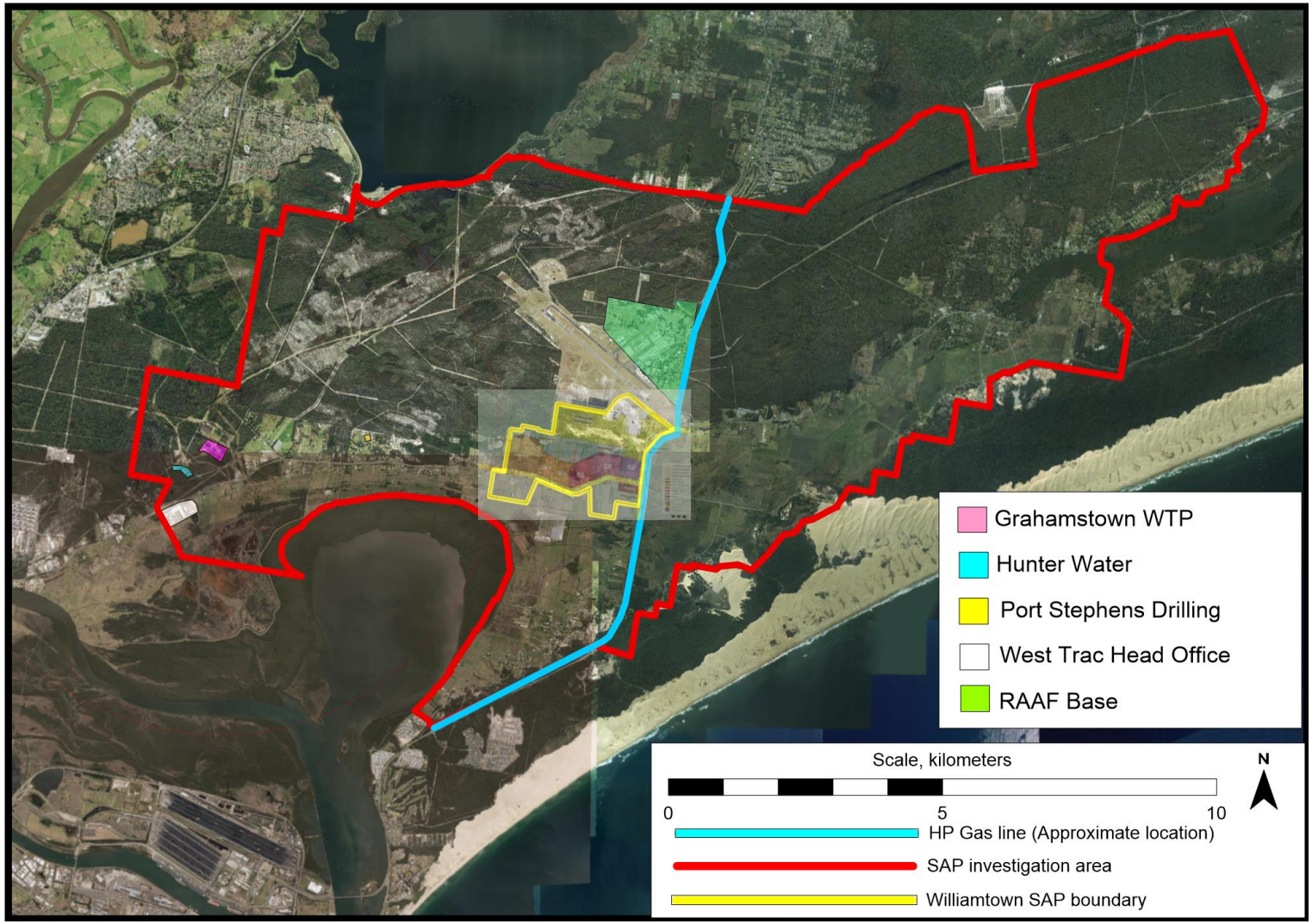
4.3. Existing industrial developments

Existing industrial developments are listed in Table 4.3 and shown on the map in (Figure 4.1). The developments listed are in the Williamtown SAP investigation area.

Table 4.3: Existing industrial developments in SAP investigation area

Name	Key assumptions	Hazards and risks	Distance (from Williamtown SAP boundary)
Grahamstown water treatment plant	Existing water treatment plant with chlorine storage onsite.	Potential for release of chlorine with offsite impact.	5 km west
Hunter Water	Existing water treatment plant with chlorine storage onsite.	Potential for release of chlorine with offsite impact.	5.5 km west
Port Stephens Drilling Pty Ltd	Existing boring and drilling contractors. No explosives stored on site.	No hazards with offsite risk potential	+2.4 km west
WesTrac BWS Head Office	Existing construction machine dealer. Provides professional servicing of trucking, construction and mining equipment.	No hazards with offsite risk potential.	+5 km south west
RAAF Base	Existing operation. Jet fuel, weapons and munitions managed to an appropriate level by site-based systems.	Hazards understood and controlled.	600 m north
Main gas pipeline (Natural gas)	A 1050kPag pressure steel gas pipeline that runs along Nelson Bay Road which supplies gas to the area within the Port Stephens Local Government Area (LGA).	Risk managed by pipeline operator	Runs along eastern boundary.

Figure 4.1: SAP – Existing industrial developments



4.4. Other land uses

The area adjacent to the Williamtown SAP and the SAP investigation area was reviewed and the sensitive land uses (schools, hospitals and age care facilities) in Table 4.4 were identified.

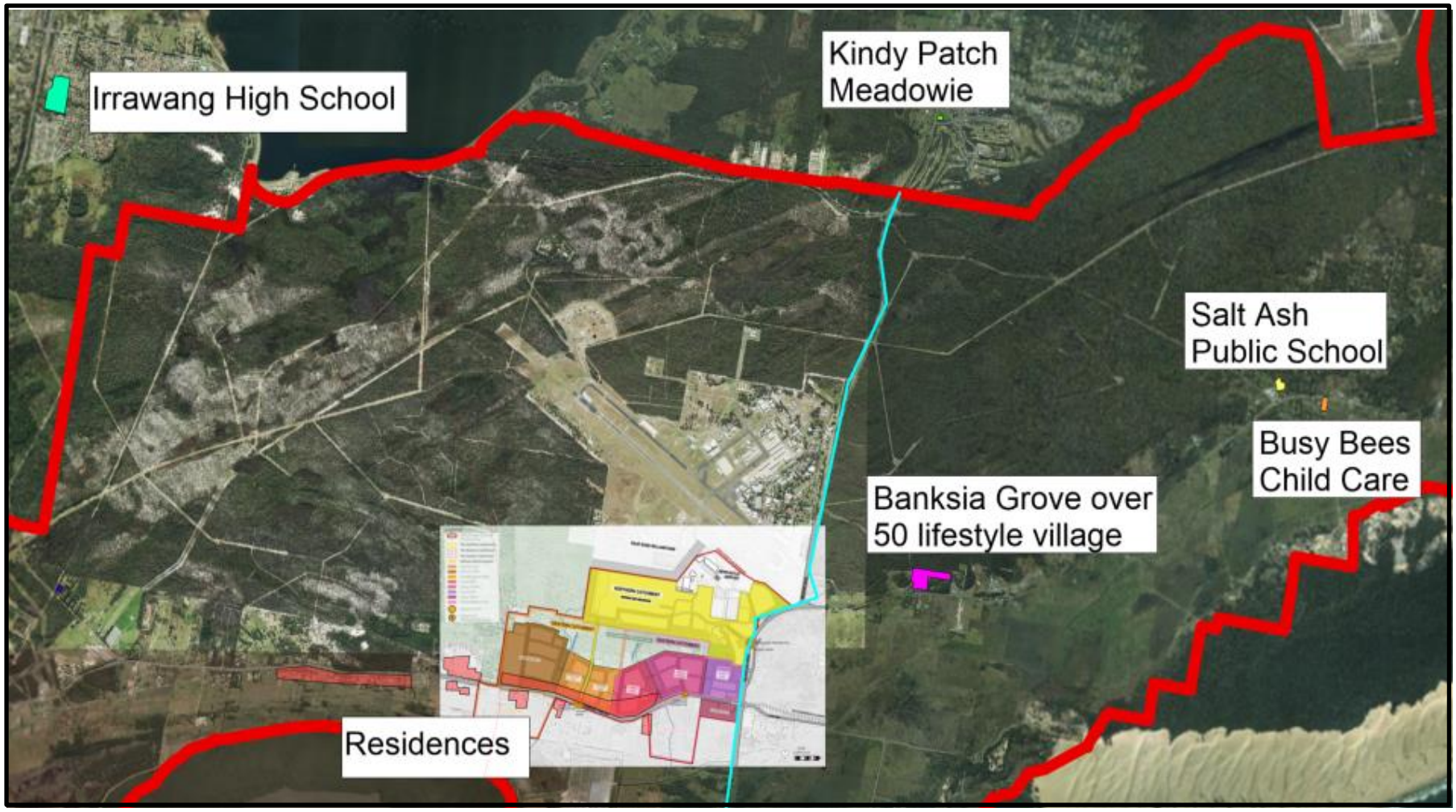
Table 4.4: Sensitive land uses

Sensitive Land use	Category	Within SAP investigation area	Direction from SAP boundary	Distance (from Williamtown SAP boundary)
Banksia Grove Village	Aged care	Yes	East	+ 1.2
Busy Bees at Salt Bush	Child care	Yes	North East	+ 5.8
Communicare Kids Heatherbrae Early education centre	Child care	No	North west	+7.8
Home Care Nursing	Aged care	Yes	West	+ 4.5
Irrawang High School	School	No	North West	+ 6.5
John Hunter Hospital	Hospital	No	South West	+16
Kindy Patch Medowie	Child care	No	North	+5
Salt Ash Public School	School	Yes	North East	+5.5

The nearest area with residential development is within the south of the Williamtown SAP .

The sensitive and residential land uses are shown on Figure 4.2.

Figure 4.2: Williamtown SAP – Existing sensitive and residential land uses



5. PLANNING FRAMEWORK

The DPE has developed a SEPP for SAPs. The SEPP has been updated as SAPs are approved.

Sherpa has reviewed the framework for managing land use safety planning with the following findings:

- land use safety risk can be managed by ensuring that SEPP 33 is applied in conjunction with the requirements of HIPAP 12 (Hazards Related Conditions of Consent) to ensure conditions of consent are based on an assessment of the potential consequence and risk of a development. High risk developments (in the context of HIPAP 12) should be excluded from complying development pathways. The Master Plan should clearly state the requirement to apply the SEPP 33 screening at the development application stage and to identity developments as high/medium/low in the context of HIPAP 12.
- MHFs are designated by the regulator based on a notification made by the operator. Notification is required (NSW WHS Act and supporting Regulation) if the facility is predicted to exceed 10% of the MHF threshold quantities of listed materials (Schedule 15). Designation and management of MHFs sits outside of the development application and use safety planning framework. The status of a development as an MHF may not be determined until after the facility is constructed. The Master Plan should exclude developments that exceed 10% MHF threshold from any simplified planning framework to reduce the potential for a development to be designated as an MHF after development approval and ensure any risks are given due consideration during the approval process.
- the Master Plan should specially address where child-care facilities can be developed. There is the potential for child-care facilities to result in land use safety conflict. The Delivery Plan should consider controls to manage the location of child-care facilities in the vicinity of potentially hazardous facilities.
- consideration should be given to limiting the nature and scale of public recreation facilities in the vicinity of potentially hazardous activities. Activities or facilities that draw large crowds should be managed to avoid societal risk land use safety conflict.
- there are currently no high flow rate liquid fuel pipelines in the area. Filling bulk storage tanks with liquid fuel at high flow rates introduces the risk of overfill and vapour cloud explosion with offsite consequences. Consideration should be given to limiting filling of bulk storage tanks from high flow rate pipelines in the control plan.

6. CASE STUDY ASSESSMENT

6.1. Overview

The agreed case studies are summarised in Table 6.1, each case study was assessed following the steps in Table 6.2.

Table 6.1: Case studies

No	Industry	Details/thresholds
1	Breweries and distilleries	Breweries or distilleries producing alcohol or alcoholic products that have an intended production capacity of more than 30 tonnes per day or 10,000 tonnes per year.
2	Ceramic and glass industries	Ceramic or glass industries (being industries that manufacture bricks, tiles, pipes, pottery, ceramics, refractories or glass by means of a firing process)— (a) that have an intended production capacity of more than 150 tonnes per day or 30,000 tonnes per year.
3	Chemical industries and works	Petrochemical industries that manufacture petrochemicals or petrochemical products in quantities of more than 2,000 tonnes per year.
4	Chemical industries and works (farm input)	Pesticide, fungicide, herbicide, rodenticide, nematocide, miticide, fumigant or related products industries: (iii) that use or produce materials classified as poisonous in the Australian Dangerous Goods Code, or (iv) that manufacture products in quantities (excluding simple blending) of more than 2,000 tonnes per year
5	Chemical industries and works	(f) plastics industries— (iii) that manufacture more than 2,000 tonnes per year of synthetic plastic resins, or (iv) that reprocess more than 5,000 tonnes of plastics per year otherwise than by a simple melting and reforming process, (g) rubber industries or works— (iv) that manufacture more than 2,000 tonnes per year of synthetic rubber, or (v) that manufacture, retread or recycle more than 5,000 tonnes per year of rubber products or rubber tyres, or (vi) that dump or store (otherwise than in a building) more than 10 tonnes of used rubber tyres
6	Petroleum works	(e) that store petroleum and natural gas products with an intended storage capacity in excess of— (iii) 200 tonnes for liquefied gases, or (iv) 2,000 tonnes of any petroleum products
7	Hydrogen generation or BESS	Small scale hydrogen generation and/or BESS.

Table 6.2: Case study assessment process

No.	Step	Criteria	Commentary
1	Define the typical process and operation	None	Sets the basis for the assessment
2	Identify typical DGs and associated hazards	Use DG classes based on Safety Data Sheet (SDS).	Defines the potential consequences associated with the facility
3	Identify the SEPP 33 screening quantities	Guide to applying SEPP 33	Sets the level of concern for the identified material. Used to assess if it is likely to have offsite consequences of concern
4	Identify 10% MHF threshold value	WHS Schedule 15	Sets an upper bound on developments that would be approved and operated under a streamlined planning process.
5	Assess against the performance objective of protecting residential amenity and health	See Table 3.2	Assess if the development has the potential to result in consequences at sensitive and residential land uses.
6	Assess the extent of individual risk profile	-	Assess if the development has the potential to exceed individual risk criteria at any land use.
7	Assess societal risk	HIPAP 10	Assess if the development has the potential to result in significant consequences in populated areas.
8	Make recommendations	-	Where criteria are no met provide recommendations for consideration as land use planning controls.

6.2. Summary of cases

6.2.1. Breweries and distilleries

The breweries and distilleries case study assessed the risk and acceptability of developing a brewery or distillery facility in the SAP. The assessment was based on the manufacture and storage of alcohol >70%. The main risk was fire from loss of containment and/or ignition of flammable liquid (alcohol).

6.2.2. Ceramics and glass industries

The ceramics and glass industries case study assessed the risk and acceptability of developing a ceramics/glass facility in the SAP. There are a number of localised occupational safety (e.g. high heat environment and molten material) and chronic health hazards (e.g. fume generated during firing or silica dust during manufacturing) associated with ceramic and glass manufacturing. There is the potential for an incident with a furnace or heater, however, the potential for offsite acute safety impact is unlikely. No land use planning safety considerations are proposed.

6.2.3. Chemicals – petrochemicals (bulk liquid fuel storage)

The consequences and risks associated with the bulk storage of flammable and combustible liquid fuels are generally understood and managed to maintain offsite consequences and risks associated with fires to within 50 or 100m of the facility.

The more significant risk associated with bulk liquid fuel terminals is a tank overfill with subsequent ignition of a flammable vapour cloud. Such incidents have occurred including at Buncefield in the UK. Whilst unlikely, a Buncefield type scenario has the potential to result in damaging overpressure 300 to 400m from the facility.

A key contributor to an overfill and subsequence explosion is the rate of tank filling and the time the overfill continues before detection. Flow rates that result in a Buncefield incident require sustained high flow rates with an overfill lasting for twenty minutes. The flow rate and inventory to sustain this type of release are associated with pipeline transfers or ship discharges.

If high filling rates are proposed for a facility the assessment under SEPP 33 and the PHA may result in the risk not meeting land use planning criteria, or will result in an offsite consequence or risk profile that is in conflict with future development in the area.

6.2.4. Chemicals – farm inputs (pesticides/herbicides/fumigants)

The chemical industry, farm inputs, case study assessed the risk and acceptability of developing a chemical manufacturing, storage and handling facility in the SAP. It was agreed with the DPE that the farm inputs chemical facility would be assessed on the basis it was used for the manufacturing and storage of pesticides, herbicides and fumigants.

The main risks are toxic products of combustion or a toxic chemical release.

6.2.5. Chemicals – plastics/rubber production

The chemical industry, plastics/rubber production, case study assessed the risk and acceptability of developing a plastics/rubber production facility in the SAP area. Fires have occurred when handling products such as tyres, these usually occur in warehouses or stockpiles. Whilst such fires may produce large amounts of thick smoke with respiratory irritants the smoke plume is typically hot and buoyant with limited potential for significant injury beyond the immediate vicinity of the fire. Other considerations such as odour mitigation are likely to result in sufficient buffer distances to other land uses and populated areas. Only localised (onsite) impacts were identified for stockpile fires.

6.2.6. Petroleum – LPG production and storage

The case study assessed the implications and acceptability of developing a LPG production, storage and distribution facility in the SAP area. The 200 tonne quantity in the case study table was not carried forward to the assessment as it is the MHF threshold

and would be subject to detailed land use safety planning and safety report requirements of an MHF.

The basis of the assessment was agreed with the DPE as a facility which stored 10-15 tonnes of LPG. The main risk was fire and explosion from release of LPG. A more significant risk associated with LPG is a Boiling Liquid Expanding Vapour Explosion (BLEVE). This is caused by the rupture of the pressurised LPG vessel (storage or road tanker) when it reaches temperatures above its boiling point.

The potential for a BLEVE from storage can be managed by mounding or burying the LPG storage tank.

6.2.7. Hydrogen generation and BESS

The generation of hydrogen or storage of electricity in a BESS case study assessed the risk and acceptability of developing these facilities in the SAP area.

The associated hazards are:

- Electrical
- Release and ignition of hydrogen.

Electrical hazards (e.g. arc flash, transformer fires and electrocution) are typically localised to the equipment.

Hydrogen releases have the potential to result in explosions or jet fires with the potential for offsite consequence.

The assessment was based on a hydrogen production and vehicle refuelling facility for public access. Hydrogen would be produced on demand by electrolysis with minimal storage.

A facility suitable for commercial hydrogen truck fleet refuelling with hydrogen stored under pressure or liquified would require buffers that are unlikely to be accommodated in the Williamtown SAP.

Ammonia production from hydrogen with the ammonia used for industrial processes (e.g. fertilizer) or exported would require a large production plant footprint and buffer distances that are unlikely to be accommodated in the Williamtown SAP.

A review of a PHA for a hydrogen generating facility indicates that the consequences of a fire or explosion following a hydrogen release may extend up to 50m offsite. This is consistent with studies undertaken in Norway following an explosion at a hydrogen refuelling station.

6.3. Findings

The findings of the assessment are summarised in Table 6.3.

Table 6.3: Case study summary

Case study	Material	Scenario	Effect	Criteria	Distance (m)
Breweries and distilleries	Ethanol (100%)	Spill over 2900m^2 floor area	Heat	12.5kW/m^2	40
				4.7kW/m^2	100
Bulk fuel storage	Flammable liquids	15-20m diameter tank on fire	Heat	23kW/m^2	50
				4.7kW/m^2	100
Chemicals – farm inputs	Pesticides/herbicides – toxic combustion products (Class 6.1)	Uncertainty in materials and quantities - Emergency Response Guide used which is independent of quantity selected.	Toxic	Initial evacuation zone (ERP Guide 151)	800
	Fumigants – Toxic gas (Class 2.3)	Uncertainty in materials and quantities - Emergency Response Guide – small package or small spill		Protected zone (downwind at night)	700-900[3]
Chemicals – plastic/rubber production	Various flammable solid products	Building fires for the solid flammable materials	Heat	23kW/m^2	5
				4.7kW/m^2	35
LPG production and storage	LPG	20 tonne LPG vessel BLEVE (mass inside vessel 10 tonnes at time of BLEVE)	Heat	23kW/m^2	140
				4.7kW/m^2	380
Hydrogen generation and BESS[(a)]	Hydrogen gas	Release and ignition of hydrogen	Heat	23kW/m^2	50-75
			Explosion	21kPa	50
Notes: (a) BESS consequences are localised.					

[3] The values quoted are a range based on the 2018 (900m) and the 2021 (700m) versions of the guide.

6.4. Buffer zones

The assessment of the case studies highlights that if the developments were located in the southern area of the SAP, then there is the potential for land use safety conflict with existing residential land uses.

The assessment shows that the acute effects of fires and explosions from the majority of case studies can be managed with a 150m buffer zone.

Buffer zones could be placed around existing residences on the basis there will be no new residential development within 150m of the SAP boundary. Figure 6.1 shows the 150m buffer zone around existing properties.

The assessment shows that the use of buffer zones to manage the acute effects (consequences) of toxic releases or products of combustion with injury/irritation exposure levels would have the potential to unnecessarily restrict developments up to 900m from the SAP. These effects would be better managed under a risk-based framework.

Figure 6.2 shows an 800m and 900m buffer around a possible source of a pesticide or fumigant release to indicate the extent of a protection or evacuation zone that may be required in the event of a release of fumigant (toxic gas). It is noted that this reaches existing residential areas.

Table 6.4: Benefit of buffer zones

Case study	Material	Scenario	Effect	Criteria	Distance (m)	Buffer mitigates consequence?					
						<50 m	50m-150m	150m-500m	500m-1km	1km-3km	3km-4km
Chemicals – plastic/rubber production	Various flammable solid products	Building fires for the solid flammable materials	Heat	23kW/m^2	5	Yes					
Breweries and distilleries	Ethanol (100%)	Spill over 2900m^2 floor area	Heat	23kW/m^2	40	Yes					
Bulk fuel storage	Flammable liquids	15-20m tank on fire	Heat	23kW/m^2	50	No	Yes				
Hydrogen generation and BESS	Hydrogen gas	Release and ignition of hydrogen	Heat	23kW/m^2	50	No	Yes				
LPG production and storage	LPG	20 tonne LPG vessel BLEVE (mass inside vessel 10 tonnes)	Heat	23kW/m^2	140	No	Broadly	Yes			
Chemical – farm inputs	Pesticides/ herbicides – Toxic combustion products (Class 6.1)	Uncertainty in materials and quantities - ERG guide which is independent of quantity selected.	Toxic	Initial evacuation zone	800	No			Broadly	Yes	
Chemicals – farm inputs	Fumigants – Toxic gas (Class 2.3)	Uncertainty in materials and quantities - ERG guide – small package or small spill	Toxic	Protected zone (downwind at night)	700-900	No			Broadly	Yes	

Figure 6.1: 150m buffer zone

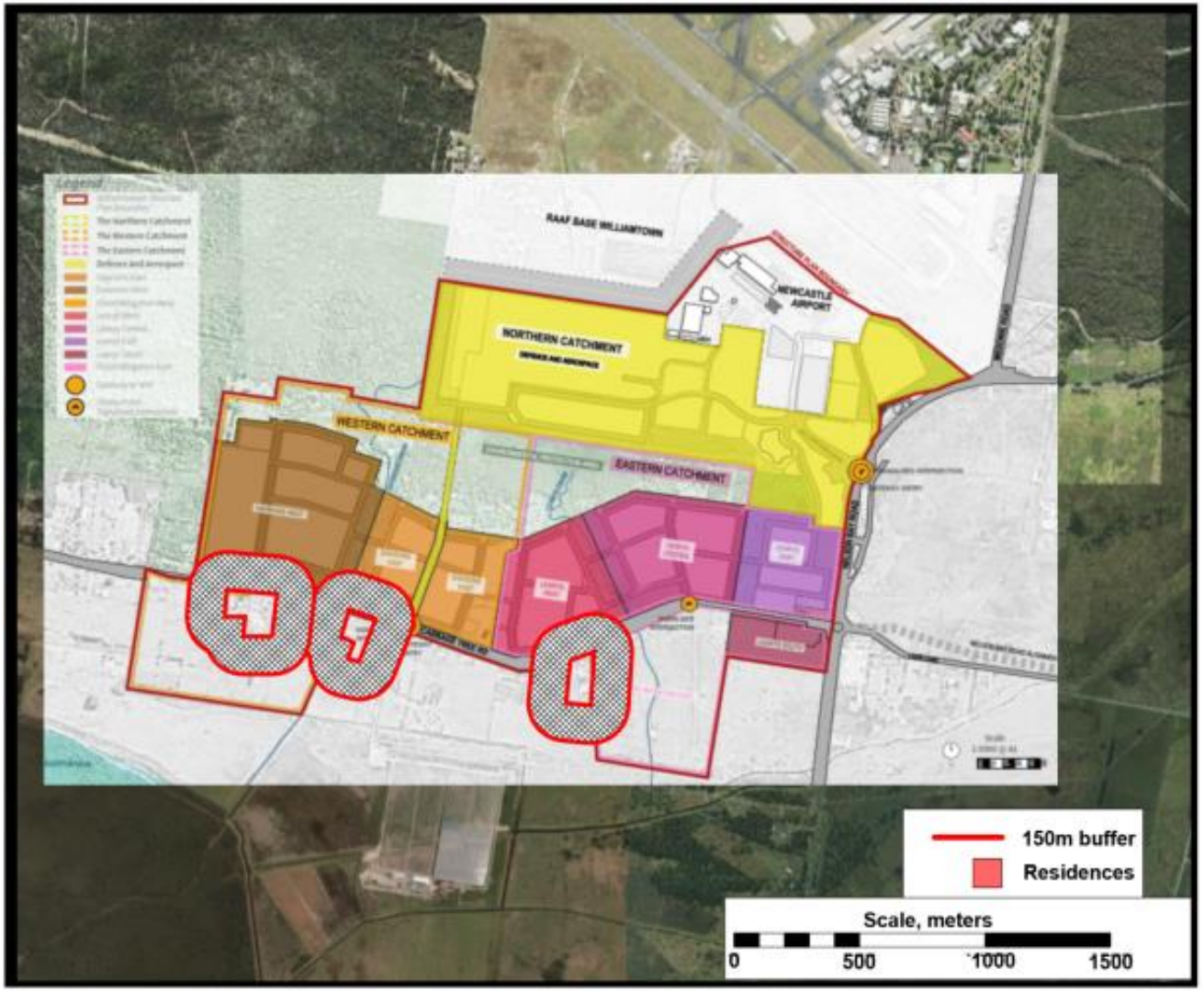
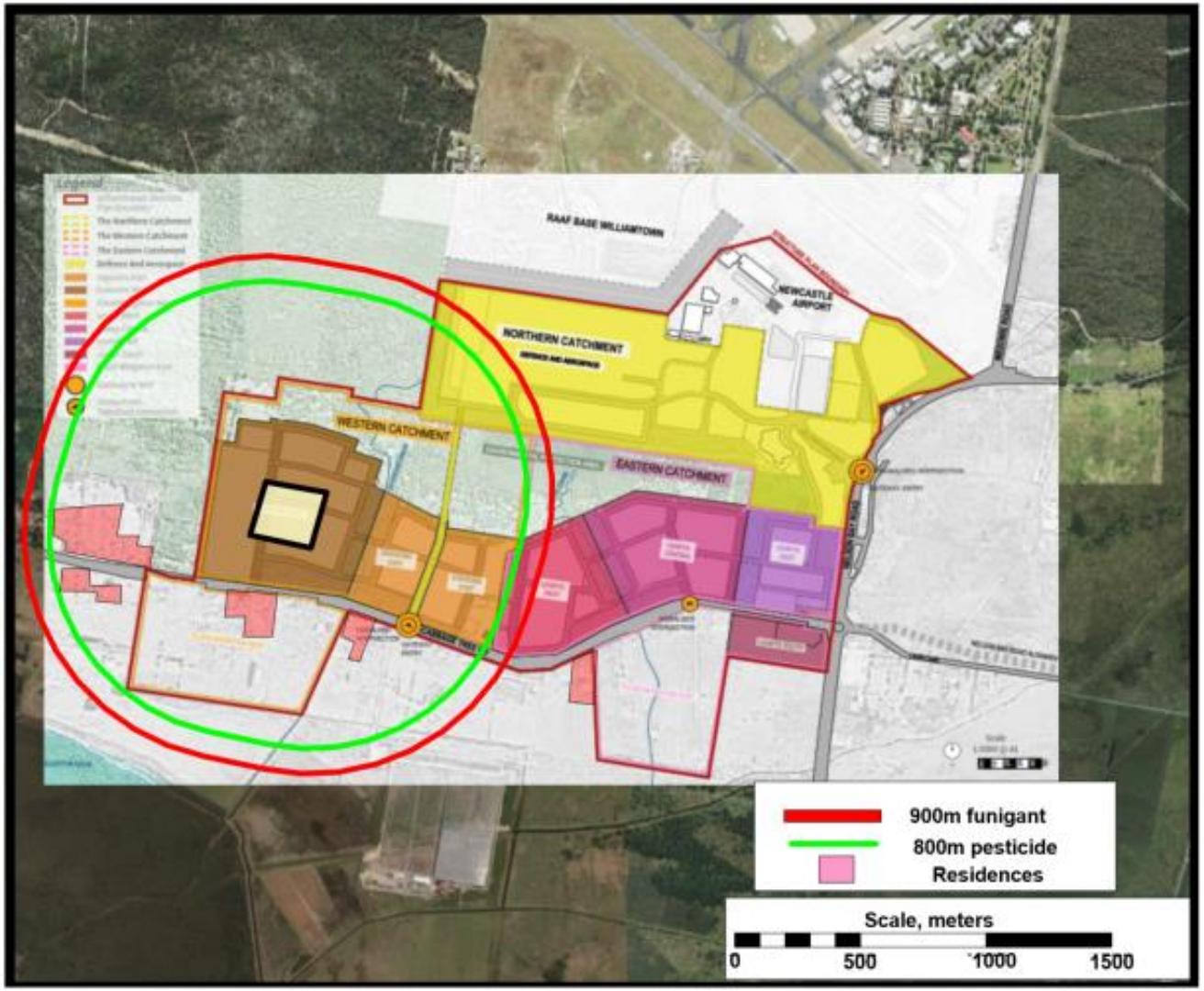


Figure 6.2:Pesticide/herbicide and fumigant toxic extent



7. GENERAL INDUSTRY ASSESSMENT

7.1. Approach

The general industries in Table 7.1 were screened to identify:

- industries covered by an equivalent case study (the finding from the case study were applied to the industry)
- industries with no significant offsite potential (screened as being acceptable with no additional controls).

The remaining industries were assessed to identify significant issues that should be taken into consideration in a strategic planning context. The assessment identified typical processes, hazardous materials, and incidents with potential offsite consequences.

Table 7.1: General industries for consideration

No	Industry
11	Fertiliser productions (such as ammonia)
12	Bitumen
13	Food processing (e.g. abattoir)

7.2. Screening

The results of the screening exercise are presented in Table 7.2.

Table 7.2: General industries - screening

No	Industry	Commentary	Screening
11	Fertiliser productions	Storage and handling of ammonia (toxic) and AN solution (Oxidising)	Carry forward for assessment
12	Bitumen	Storage and handling of combustibles and flammables	Carry forward for assessment
13	Food processing waste streams (e.g. abattoir)	Ammonia in refrigeration circuits has offsite potential	Carry forward for assessment

7.3. Fertiliser production

The chemical industry (fertiliser) assessed the risk of developing a fertiliser manufacturing facility in the SAP. The most hazardous fertiliser manufacturing process uses ammonia (toxic and flammable) and acids (corrosives) to produce AN. The consequence of an explosion of 500 tonnes of AN (10% of the MHF Schedule 15 threshold) has the potential to result in damage to buildings at up to 500m and damage to equipment at 350m.

7.4. Bitumen production

The basis of the assessment was a facility that imports bitumen feedstock, diesel and additives. Specified grades of bitumen are produced in batches through a process of

heating and mixing the feedstock with diesel and additives. The option to incorporate recycled products, such as tyres, into the bitumen was considered. The main risk is a bulk storage tank fire.

7.5. Food processing - abattoir

Food processing facilities have the potential to use ammonia in refrigeration circuits. The basis of the assessment was a food processing facility with up to 20 tonnes of ammonia (just below MHF notification threshold). The main risk is the offsite toxic impact from ammonia.

7.6. Summary of findings

The general industrial developments were assessed to determine the potential for significant offsite impact. Three new scenarios where buffer zones have the potential to reduce the potential for land use safety conflict are summarised in Table 7.3.

The results show that the acute effects of fires from the bitumen facility can be managed by the 150m buffer zone proposed for the case studies.

The acute effects of fires and explosions associated with AN and the toxic effects of an ammonia release could be managed with 500m and 900m buffer zones respectively. However, due to the size of the SAP, it is unlikely these buffer zones would be practicable. Based on this assessment, it is unlikely the SAP can accommodate a fertiliser plant or a food processing facility with a significant ammonia inventory and these developments would not be advised as suitable for the Williamtown SAP.

Table 7.3: General industry - Benefit of perimeter buffer zones

Industry	Material	Scenario	Effect	Distance	Buffer mitigates consequence?					
					<50m	50m-200m	200m-500m	500m-1km	1km-3km	3km-4km
Bitumen	Bitumen or diesel above flash point	19m diameter on fire	Heat Radiation	50m	Yes					
Chemical – fertiliser	Ammonium Nitrate Fertilisers	500 Tonnes (10% MHF)	Explosion (21kPa – equipment damage)	350m	No			Yes		
Chemical – fertiliser	Ammonium Nitrate Fertilisers	500 Tonnes (10% MHF)	Explosion (7kPa – impact on residential)	500m	No			Yes		
Chemical –food processing	Ammonia	20 Tonnes (10% MHF)	Toxic (ERPG 2)	4km	No					Yes

8. EXISTING INDUSTRIAL DEVELOPMENT ASSESSMENT

8.1. Approach

The existing industries in Table 8.1 were screened to identify:

- industries covered by an equivalent case study (the finding from the case study was applied to the industry)
- industries with no significant offsite potential.

The remaining industries were assessed to identify any significant issues that should be taken into consideration in a strategic planning context. The assessment identified typical processes, hazardous materials, and incidents with potential offsite consequences.

Table 8.1: Screening of existing industrial development

Name	Commentary	Screening
Grahamstown water treatment plant	Potential for release of chlorine with offsite impact	No case study – land use safety considerations for water treatment plant
Hunter Water	Potential for release of chlorine with offsite impact	No case study – land use safety considerations for water treatment plant
Port Stephens Drilling Pty Ltd	No hazards with offsite risk potential	No significant offsite potential
WesTrac BWS Head Office	No hazards with offsite risk potential	No significant offsite potential
RAAF Base	Hazards identified and controlled	-
Main gas pipeline (Natural gas)	A 1050kPag steel gas pipeline that runs along Nelson Bay Road which supplies gas to the area within the Port Stephens LGA	No case study – land use safety considerations for pipelines

8.2. Grahamstown Water Treatment Plant and Hunter Water

The water treatment plants are in the southwest corner of the SAP investigation area and approximately 5km away from the Williamtown SAP. They have storage of chlorine cylinders on site where each cylinder has a maximum capacity of 789L, with typically 10-14 full cylinders stored on site. The main risk from this is potential for toxic release of chlorine gas. No credit or account is taken in the assessment of controls (e.g. chlorine detection and shutdown or vents with scrubbers).

The consequence impact of a release of chlorine to injury/irritation exposure levels has the potential to extend more than 5km in distance. As per previous assessment of the case studies, toxic releases would be managed under an existing risk-based framework

on site. As the facilities are approximately 5km away from the SAP boundary, there are limited impacts on developments in the SAP.

8.3. Pipelines

Typically, the risk from a pipeline is of concern for residential or sensitive land uses. The risk criteria for commercial and industrial developments is typically not generated by the pipeline.

Risks to the pipeline are managed by the pipeline operator in consultation with the developer.

The control plan should include considerations to limit the development of residential or sensitive land uses (e.g. a child care centre) adjacent to the pipeline.

9. INDUSTRIAL LAND USE CONFLICTS

The results of the case studies, general industry and existing developments were used to identify areas of land use safety conflict between potentially hazardous industrial developments.

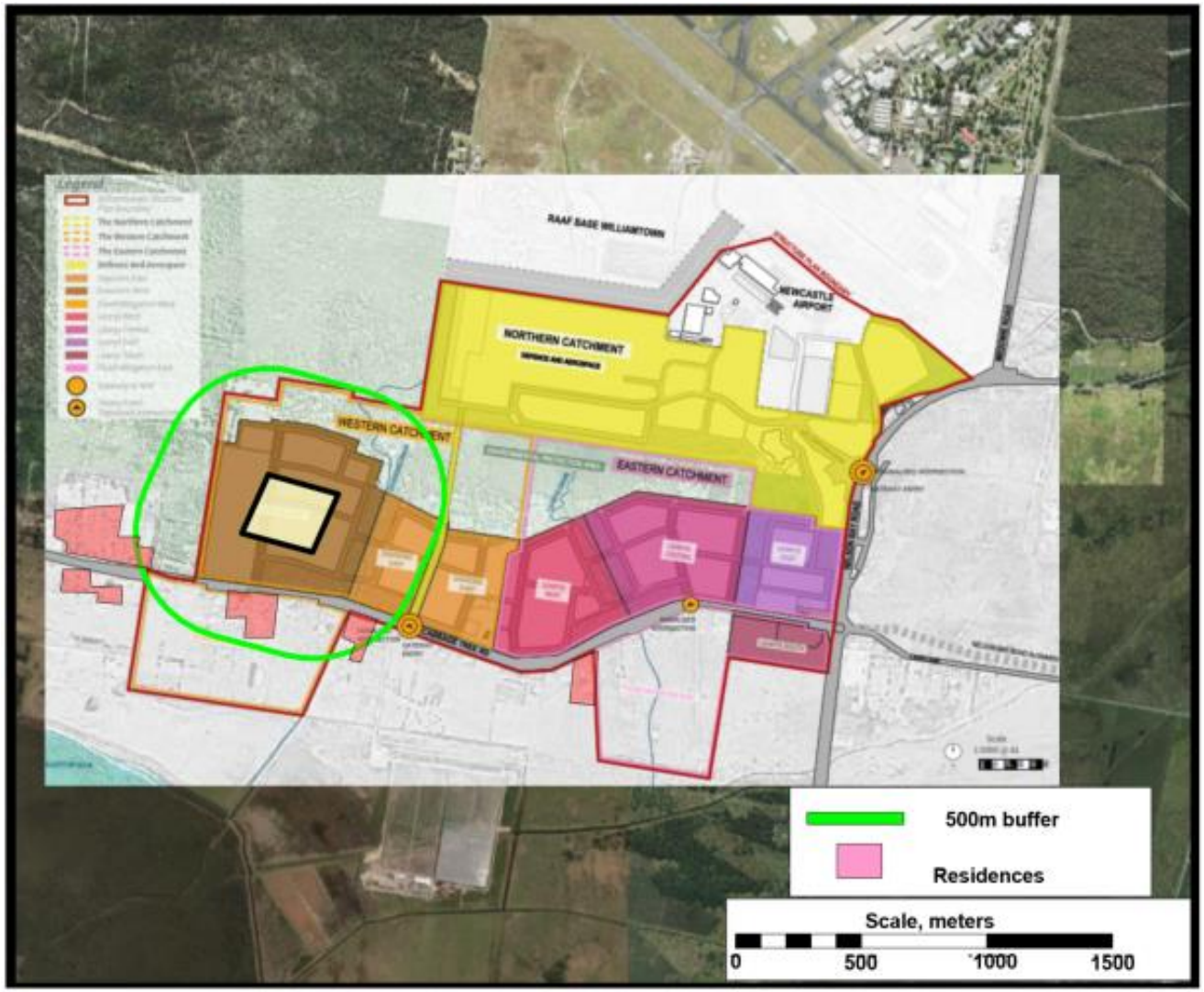
The application of SEPP 33 and the PHA process will be the primary means of managing offsite risk from industrial developments to neighbours. In general, the relevant risk criteria are expected to be met with the application of engineering controls.

The main potential land use safety conflict that has been identified is associated with a fertiliser manufacturing facility. The impact of an AN explosion, has the potential to result in escalation to an adjacent facility at 300m and injury risk up to 500m (based on an 10% MHF inventory of AN). This would result in a recommendation for a 500m buffer zone around the facility. The current SAP configuration is unlikely to accommodate this scale of buffer zone (Figure 9.1).

A fertilizer facility proponent may prepare a PHA under SEPP33 that takes account of the specific processes, inventory and controls to demonstrate risk compliance. This option would require the risk assessment to take account of future receptors in the area to avoid sterilisation of land.

Consideration will be required to manage the risk associated with developments adjacent to the gas pipeline. This will include engagement with the pipeline operator to establish the extent of the consultation zones for developments adjacent to the pipelines.

Figure 9.1: Fertiliser facility buffer zone



10. ALTERNATIVE FACILITY LOCATIONS

The Western catchment was assessed as the preferred location for all potentially hazardous facilities.

Alternative locations were assessed for:

- Ceramics and glass industries
- Hydrogen generation.

Due to the limited offsite consequences, these industries can potentially be located in the Western catchment. There is no significant impact to residential or sensitive land uses in these locations.

11. CONCLUSIONS

A hazard and risk assessment has been completed based on the proposed SAP against a set of case studies, general industries and existing activities. The study:

- identifies potential land use safety conflicts using a set of case studies and risk criteria from HIPAP 10.
- identifies preferred locations for potentially hazardous developments.
- proposes buffer distances based on typical inventories and land use safety considerations along with proposed beneficial activities that may be appropriate in the buffers.
- assesses types of development that may not be appropriate for the SAP.
- identifies additional areas for consideration in the Master Plan.

The overall findings of the study are:

- SEPP 33 and the requirement to complete a PHA for potentially hazardous industries is an appropriate framework for managing land use safety conflicts.
- the preferred location for higher risk (potentially hazardous industries) users is the western catchment, with a transition to lower risk industries in the east and north of the SAP
- there are residences in the SAP. Controls will be required in the Master Plan to manage the transition from residential to employment. The timing of any change will be dependent on the staging of the SAP development taking into account the need to manage risk levels at residences.
- there are existing residences adjacent to the SAP boundary. To manage land use safety conflict with existing residences outside the SAP the following controls are proposed
  - 150m buffer zone around existing residences would limit the potential for land use safety conflict with the potentially hazardous developments assessed in this study for all but the largest toxic releases (Figure 11.1).
  - buffer zones to manage the consequences of toxic spills or toxic products of combustion could extend up to 900m resulting in unnecessary limitations on developments in the SAP. Given the small scale of the SAP and the exiting residential developments buffer zones are unlikely to be practicable. Such risks are best managed through the risk-based SEPP 33 process.
- notwithstanding the potentially permissibility under SEP33, based on the relatively small area available for development in the SAP and the proximity of existing and proposed populations, developments with the following hazardous materials and

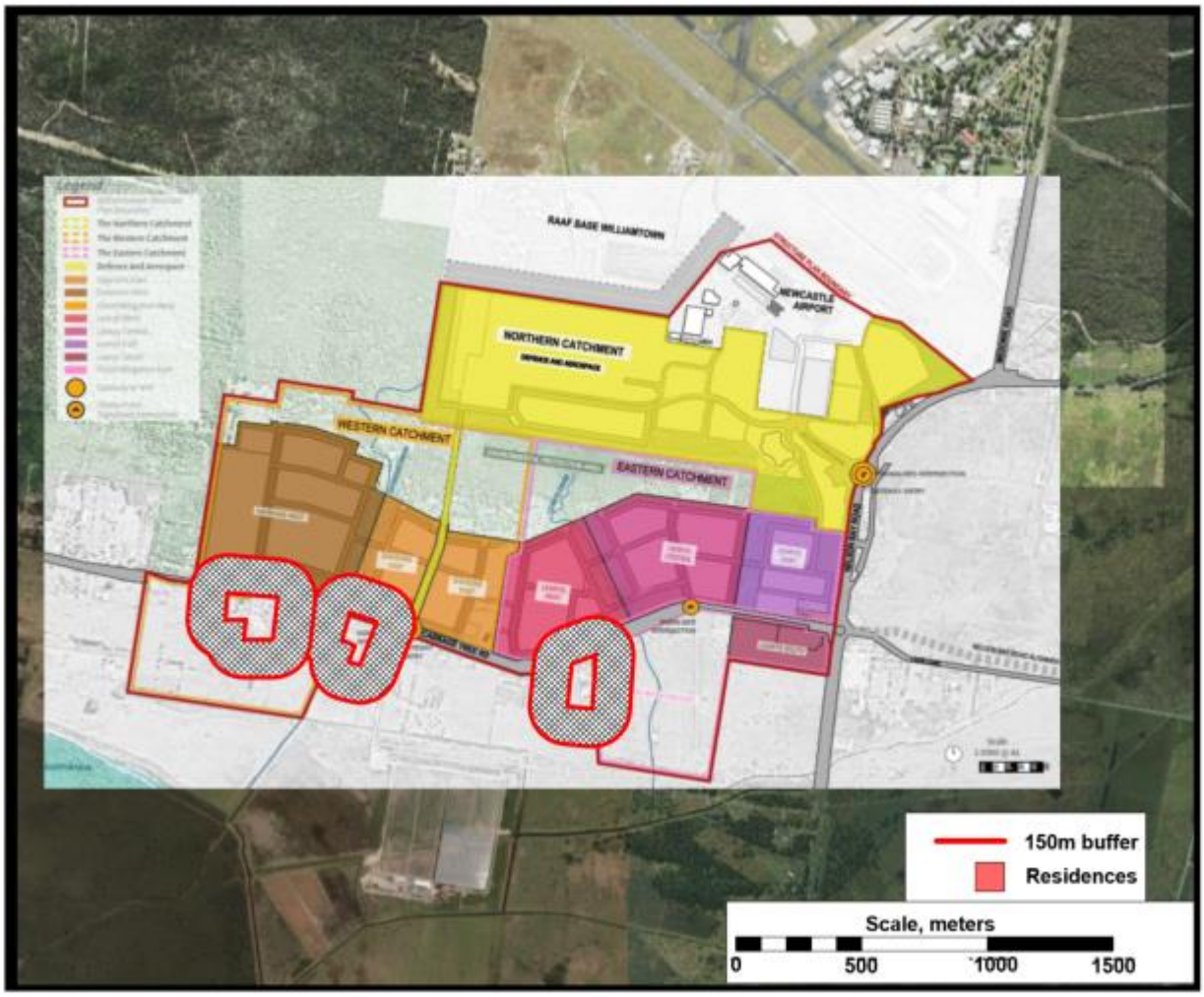
activities are not considered appropriate for the SAP as they may preclude development more aligned to the proposed character of the SAP:

  - any facility that exceeds the 10% of the MHF threshold as detailed in Schedule 15 of the NSW WHS regulations.
  - handling or storage of AN (such as fertiliser manufacturer) in quantities that exceed the SEPP 33 screening threshold.
  - handling or storage of ammonia (such as fertiliser manufacturer or food/abattoir with ammonia refrigeration circuit) in quantities that exceed SEPP 33 screening thresholds.
  - LPG storage in above ground tanks that exceed the SEPP 33 screening threshold. Storage in mounded or buried tanks will minimise the consequences of the largest events and should be assessed in a PHA.
  - facilities that handle and/or store toxic substances (Class 6) that exceed the SEPP 33 screening threshold (such as freight facility with toxic substances).
  - facilities that import liquified petroleum product by pipeline and store in above ground atmospheric tanks are not appropriate due to the potential for overfill and subsequent large vapour cloud explosion.
  - storage of hydrogen in bulk is likely to result in land use safety conflict due to the relatively small scale of the SAP. Hydrogen generated for immediate consumption (e.g. vehicle refuelling) is unlikely to result in land use safety conflict.

- a high-pressure gas pipeline runs along the eastern boundary of the SAP. It is recommended that DPE consult with Jemena (the pipeline operator) to determine the requirements for buffer zones or any implications of rezoning or population intensification in the vicinity of the pipeline. The consent authority should notify the pipeline operator of any development applications in Learys East, Learys South and the eastern section of the northern catchment and ensure the safety risks from the pipeline or safety risks to the pipeline during construction and occupancy of the development are taken into consideration.
- development controls will be required to manage development in the environmental protection area to limit the potential for commercial activities that result in an increase in population in the area (e.g. café or sporting fields).
- development controls will be required to manage risks that relate to research and development activities due to:
  - risks and required controls not well understood and activities that may not fall under a standard approach.
  - risks associated with scaling up facilities that may not be understood at the initial development application stage.

- activities that may be perceived to be temporary in nature and hence not require development approval.

Figure 11.1: 150m buffer zone



APPENDIX A. CASE STUDY ASSESSMENT

A1. Case studies

Table A.1: Case studies

No	Industry	Details/thresholds
1	Breweries and distilleries	Breweries or distilleries producing alcohol or alcoholic products that have an intended production capacity of more than 30 tonnes per day or 10,000 tonnes per year.
2	Ceramic and glass industries	Ceramic or glass industries (being industries that manufacture bricks, tiles, pipes, pottery, ceramics, refractories or glass by means of a firing process)— (a) that have an intended production capacity of more than 150 tonnes per day or 30,000 tonnes per year.
3	Chemical industries and works	Petrochemical industries that manufacture petrochemicals or petrochemical products in quantities of more than 2,000 tonnes per year.
4	Chemical industries and works	Pesticide, fungicide, herbicide, rodenticide, nematocide, miticide, fumigant or related products industries: (v) that use or produce materials classified as poisonous in the Australian Dangerous Goods Code, or (vi) that manufacture products in quantities (excluding simple blending) of more than 2,000 tonnes per year
5	Chemical industries and works	(f) plastics industries— (v) that manufacture more than 2,000 tonnes per year of synthetic plastic resins, or (vi) that reprocess more than 5,000 tonnes of plastics per year otherwise than by a simple melting and reforming process, (g) rubber industries or works— (vii) that manufacture more than 2,000 tonnes per year of synthetic rubber, or (viii) that manufacture, retread or recycle more than 5,000 tonnes per year of rubber products or rubber tyres, or (ix) that dump or store (otherwise than in a building) more than 10 tonnes of used rubber tyres, or
6	Petroleum works	(e) that store petroleum and natural gas products with an intended storage capacity in excess of— (v) 200 tonnes for liquefied gases, or (vi) 2,000 tonnes of any petroleum products
7	Hydrogen generation or BESS	Small scale hydrogen generation and storage facility or BESS.

A2. Breweries and distilleries

The breweries and distilleries case study assessed the risk and acceptability of developing a brewery or distillery facility in the SAP. The assessment was based on the manufacture and storage of alcohol >70%.

A2.1. Summary of process hazards

Hazards include flammable liquids and typical hazardous materials are listed by DG class in Table A.2.

Table A.2: Chemical industry – fertiliser hazardous materials

Typical material on site	DG Class	Hazards	SEPP 33 threshold	10% MHF threshold	Comment
>70% alcohol (ethanol)l	3 PGII	Flammable	5 tonnes	5000 tonnes	Potential for explosion overpressure if vapour accumulates or pool fire

A2.2. Consequence assessment

The results from a PHA of a typical plant were used to assess the extent of any release (Table A.3).

The distance to 4.7kW/m^2 was used to assess the consequences of an incident at the facility.

Table A.3: Brewery and distillery – consequence results

	Results
Consequence	Consequences based on a 2900m^2 floor space as alcohol inventory is bunded. Distance from edge of bund. 100m to 4.7kW/m^2 40m to 12.5kW/m^2

Table A.4: Brewery and distillery - performance objectives

Factor for determining appropriate separation distances	Comment
What is the likelihood of the performance objective being achieved by the mitigation measures alone?	There is the potential for offsite release based on the materials on site.
What is the likelihood of the mitigation measure failing?	
What is the likelihood of an incident which will result in a failure to meet the performance objectives?	
What back up mitigation measures are available?	
What is the likely geographic extent of the impacts if mitigation measures fail or an incident occurs?	Heat radiation may extend 100m offsite to injury levels
What separation distances are required to achieve the performance objective if mitigation measures fail or an incident occurs?	

A3. Ceramics and glass industry

The ceramics and glass industry case study assessed the implications and acceptability of developing a ceramics and glass facility.

A3.1. Summary of process hazards

The general hazards with ceramics and glass industry were identified as firing of furnaces which can use numerous heat sources, e.g. fuel oil, electricity, natural gas.

The hazards, risks and controls around furnaces are understood. Whilst there is the potential for a furnace explosion the consequences will be limited to onsite

A4. Chemical industry – petroleum (bulk liquid storage)

The bulk liquid case study assessed the risk and acceptability of developing a bulk storage facility in the SAP. A typical storage facility was assessed as including aboveground, vertical, atmospheric storage tanks between 15 and 20m in diameter. Height was not considered to allow for the tank burn down scenario.

A4.1. Summary of process hazards

Hazards include flammable and combustible liquids. Typical hazardous materials are listed up DG class in Table A.5.

Table A.5: Bulk storage facility

Typical material on site	DG Class	Hazards	SEPP 33 threshold	10% MHF threshold	Comment
Diesel	Combustible	Can be involved in a fire	None	None	Diesel when heated above flash point are flammable.
Gasoline	3 PGII	Fire and explosion	5 tonnes	5000 tonnes	Potential for explosion if vapours accumulate or fire
Jet fuel	3 PGIII	Corrosive	5 tonnes	5000 tonnes	Potential for explosion if vapours accumulate or fire

A4.2. Consequence assessment

The results from a PHA of a typical plant were used to assess the extent of any release (Table A.6).

The distance to 4.7kW/m^2 was used to assess the consequences of an incident at the facility.

Table A.6: Bulk fuel storage – consequence results

	Results
Consequence	Consequences based on a 19m diameter tank fire: 100m to 4.7kW/m^2 45m to 23kW/m^2

Table A.7: Bulk fuel storage - performance objectives

Factor for determining appropriate separation distances	Comment
What is the likelihood of the performance objective being achieved by the mitigation measures alone?	There is the potential for offsite release based on the materials on site.
What is the likelihood of the mitigation measure failing?	
What is the likelihood of an incident which will result in a failure to meet the performance objectives?	
What back up mitigation measures are available?	
What is the likely geographic extent of the impacts if mitigation measures fail or an incident occurs?	Heat radiation may extend 100m offsite to injury levels
What separation distances are required to achieve the performance objective if mitigation measures fail or an incident occurs?	

A5. Chemical industry – farm inputs

The chemical industry, farm inputs, case study assessed the risk and acceptability of developing a chemical manufacturing, storage and handling facility in the SAP. It was agreed with the DPE that the chemical facility would be assessed on the basis it was used for the manufacturing and storage of pesticides/herbicides and fumigants.

A5.1. Summary of process and hazards

The general processes for pesticide and herbicide production and storage are as follows:

1. Synthesizing, where the active ingredients are produced.
2. Formulating, where the active ingredient is sent to the formulators to mix the correct amount with a carrier medium. The formulation is packaged for distribution, usually in a concentrated form and may be a liquid or powder.
3. Diluting, where the formulation is stored and may be diluted and repackaged before distribution, or distributed in a concentrated form for the end user to dilutes to create the amount of pesticide/herbicide required.

Typical hazardous materials are listed by DG class in Table A.8.

Table A.8: Chemical industry – farm inputs hazardous materials

Typical material on site	DG Class	Hazards	SEPP 33 threshold	Comment
MIPA - Monoisopropyl Amine (highly flammable but also highly odorous and irritating)	Class 3.1 PGI	Flammable liquid	Varies with distance to site boundary. Typical value is 80 tonne storage at 10m from site boundary in an industrial area.	Dependant on layout, heat radiation effects may extend offsite but likely to be limited to immediate area of facility
Paraquat (herbicide), diquat (pesticide)	Class 6.1 PG III	Toxic	2.5 tonnes for PGIII	Toxic exposure to spill localised to area. Toxic products of combustion in a fire event may extend offsite
Phosphine fumigant tablets	Class 6.1 PG I	Toxic	0.5 tonnes for PGI	Generates toxic gas on exposure to water
Methyl Bromide	Class 2.3	Toxic	100kg	Toxic gas

Based on the assessment in Table A.8, it is credible that the mitigation controls at the chemical facility may fail resulting in a fire involving a Class 6.1 (toxic material) or a release of toxic gas.

A5.2. Consequence assessment

Given the uncertainty in the chemical facility, chemicals used, quantities and the variables involved in predicting the evolution and dispersion of toxic products of

combustion the general guidance on emergency response contained in the 2018 Emergency Response Guidebook (US Department of transportation Pipeline and Hazardous Materials Safety Administration) was used to inform the zone of concern.

Guide 151 Toxic (non-combustible) recommends an initial evacuation zone of 800m in all directions for a fire. The values are not based on quantities but are for general advice.

The 800m distance was used to assess the worst-case credible consequence for an incident at a chemical manufacturing facility for pesticides and herbicides.

The following guidance (Table A.9) is provided for a small spill for the fumigant tablets (spill from a small package).

Table A.9: Guidance from Emergency Response Guidebook[4]

UN Code	Name	First isolation	Protect downwind distance	
			Day	Night
1397	Aluminium Phosphide (when spilled in water)	30-60m	100-200m	700-900m

A night-time spill into water has been used in the assessment.

[4] The figures quoted are a range based on the 2016 and the 2021 version of the guide. The 2021 figures are lower but in both cases the guide includes a note that actual distances may be greater. The range is used in the study.

Table A.10: Chemical industry farm inputs - performance objectives

Factor for determining appropriate separation distances	Comment
What is the likelihood of the performance objective being achieved by the mitigation measures alone?	DG quantities were assessed and show the potential for offsite impact if controls fail.
What is the likelihood of the mitigation measure failing?	
What is the likelihood of an incident which will result in a failure to meet the performance objectives?	
What back up mitigation measures are available?	
What is the likely geographic extent of the impacts if mitigation measures fail or an incident occurs?	Heat radiation from a liquid fire will be retained local to the site (10-50m) for typical bunded configurations. Toxic products of combustion may disperse offsite based on prevailing wind. Typically the plume is hot and products of combustion rise and are diluted before cooling and falling.
What separation distances are required to achieve the performance objective: If mitigation measures fail or an incident occurs?	Toxic products of combustion may extend offsite. ERG guidance of a zone of 800m (pesticides/herbicides) and 900m (fumigants) in all directions was used to assess the consequences.

A6. Chemicals – plastics/rubber production

The chemical industry, plastics/rubber production, case study assessed the risk and acceptability of developing a plastics/rubber production facility in the SAP area.

A6.1. Summary of process and hazards

Fires have occurred at when handling products such as tyres, these usually occur in warehouses or stockpiles. Whilst such fires may produce large amounts of thick smoke including respiratory irritants the smoke plume is typically hot and buoyant with limited potential for significant injury beyond the immediate vicinity of the fire. Other considerations such as odour mitigation are likely to result in sufficient buffer distances to other land uses and populated areas. Only localised (onsite) impacts were identified for stockpile fires.

A7. Petroleum – LPG production and storage

The petroleum industry, LPG, case study assessed the implications and acceptability of developing a LPG production and storage facility in the SAP area. The basis of the assessment was agreed with the DPE as a facility which stored 10-15 tonnes of LPG.

A7.1. Summary of process hazards

Typical hazardous materials are listed by DG class in Table A.11.

Table A.11: LPG storage

Typical material on site	DG Class	Hazards	SEPP 33 threshold	10% MHF threshold	Comment
LPG (aboveground)	2.1	Fire and explosion (including BLEVE)	10 tonnes	20 tonnes	Potential for significant explosion overpressure, BLEVE or fire

A7.2. Consequence assessment

The results from a PHA of a typical plant were used to assess the extent of any release (Table A.12). The main risk was fire and explosion from release of LPG. A more significant risk associated with LPG is a BLEVE. This is caused by the rupture of the pressurised LPG vessel when it reaches temperatures above its boiling point.

The distance to 4.7kW/m^2 was used to assess the consequences of an incident at the facility.

Table A.12: LPG storage – consequence results

	Results
Consequence	BLEVE 380m to 4.7kW/m^2 140m to 23kW/m^2

Table A.13: LPG production and storage - performance objectives

Factor for determining appropriate separation distances	Comment
What is the likelihood of the performance objective being achieved by the mitigation measures alone?	There is the potential for offsite release based on the materials on site
What is the likelihood of the mitigation measure failing?	
What is the likelihood of an incident which will result in a failure to meet the performance objectives?	
What back up mitigation measures are available?	
What is the likely geographic extent of the impacts if mitigation measures fail or an incident occurs?	Heat radiation may extend 380m offsite to injury levels
What separation distances are required to achieve the performance objective: If mitigation measures fail or an incident occurs?	

A8. Hydrogen generation and BESS

The generation of hydrogen or storage of electricity in a BESS case study assessed the risk and acceptability of developing these facilities in the SAP area. The basis of this assessment was on a small hydrogen facility, which includes production, storage and supply via a hydrogen electrolysis system and storage vessels, or a BESS to store power from the grid for later dispatch.

A8.1. Summary of process hazards

The hazards associated with hydrogen generation or BESS are:

- Electrical hazards
- Release and ignition of hydrogen.

Electrical hazards (e.g. arc flash, transformer fires, battery fires and electrocution) are typically localised to the equipment. Hydrogen releases have the potential to result in explosions or jet fires with the potential for offsite consequence.

Hydrogen releases have the potential to result in explosions or jet fires with the potential for offsite consequence.

The assessment was based on a hydrogen production and vehicle refuelling facility for public access. Hydrogen would be produced on demand by electrolysis with minimal storage.

A facility suitable for commercial hydrogen truck fleet refuelling with hydrogen stored under pressure or liquified would require buffers that are unlikely to be accommodated in the Williamtown SAP.

Ammonia production from hydrogen with the ammonia used for industrial processes (e.g. fertilizer) or exported would require a large production plant footprint and buffer distances that are unlikely to be accommodated in the Williamtown SAP.

A review of a PHA for a hydrogen generating facility indicates that the consequences of a fire or explosion following a hydrogen release may extend up to 50m offsite. This is consistent with studies undertaken in Norway following an explosion at a hydrogen refuelling station.

A8.2. Consequence assessment

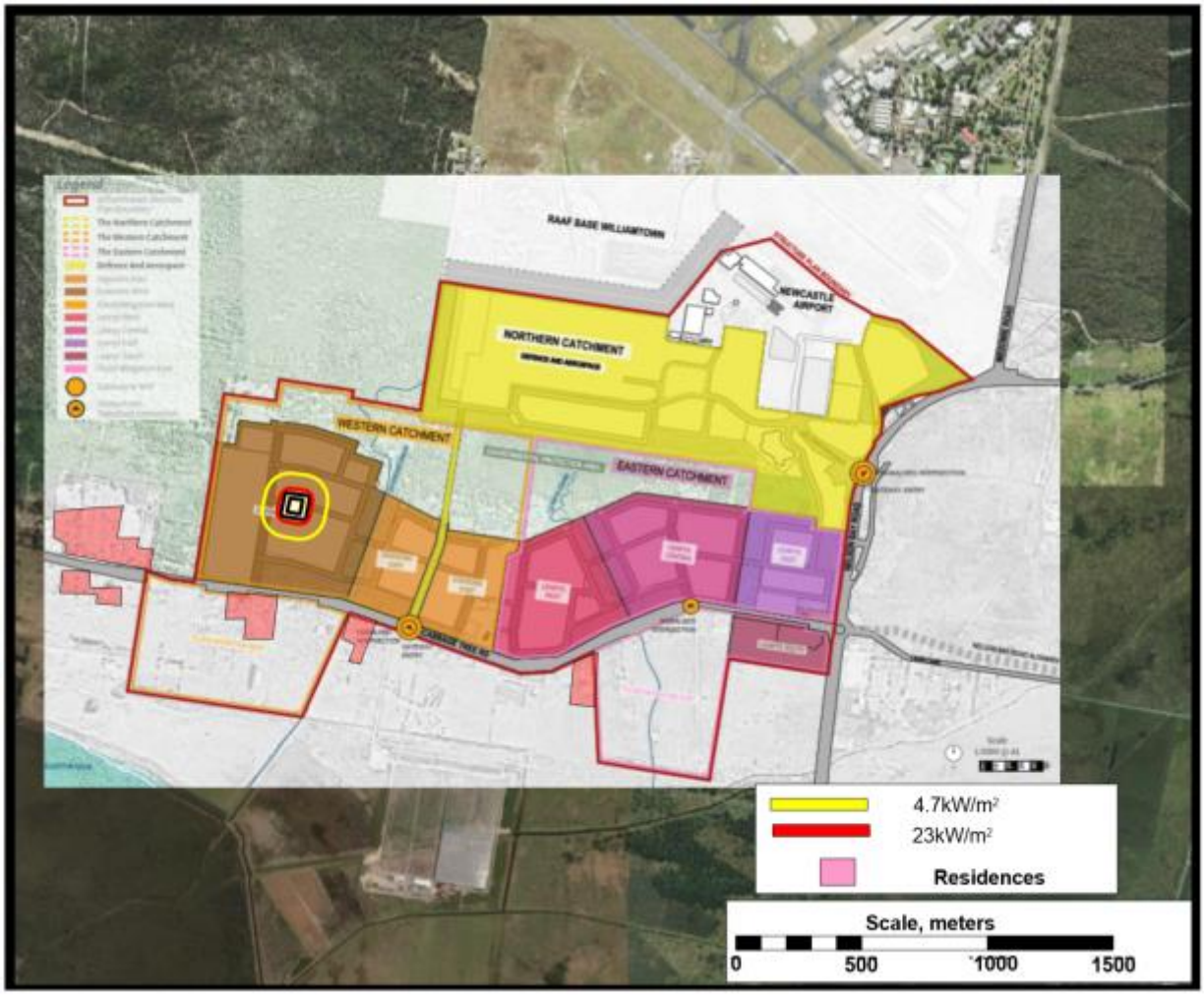
A review of a PHA for a hydrogen generating facility indicates that the consequences of a fire or explosion following a hydrogen release may extend up to 50m offsite. This is consistent with studies undertaken in Norway following an explosion at a hydrogen vehicle refuelling station.

Table A.14: Chemical industry farm inputs - performance objectives

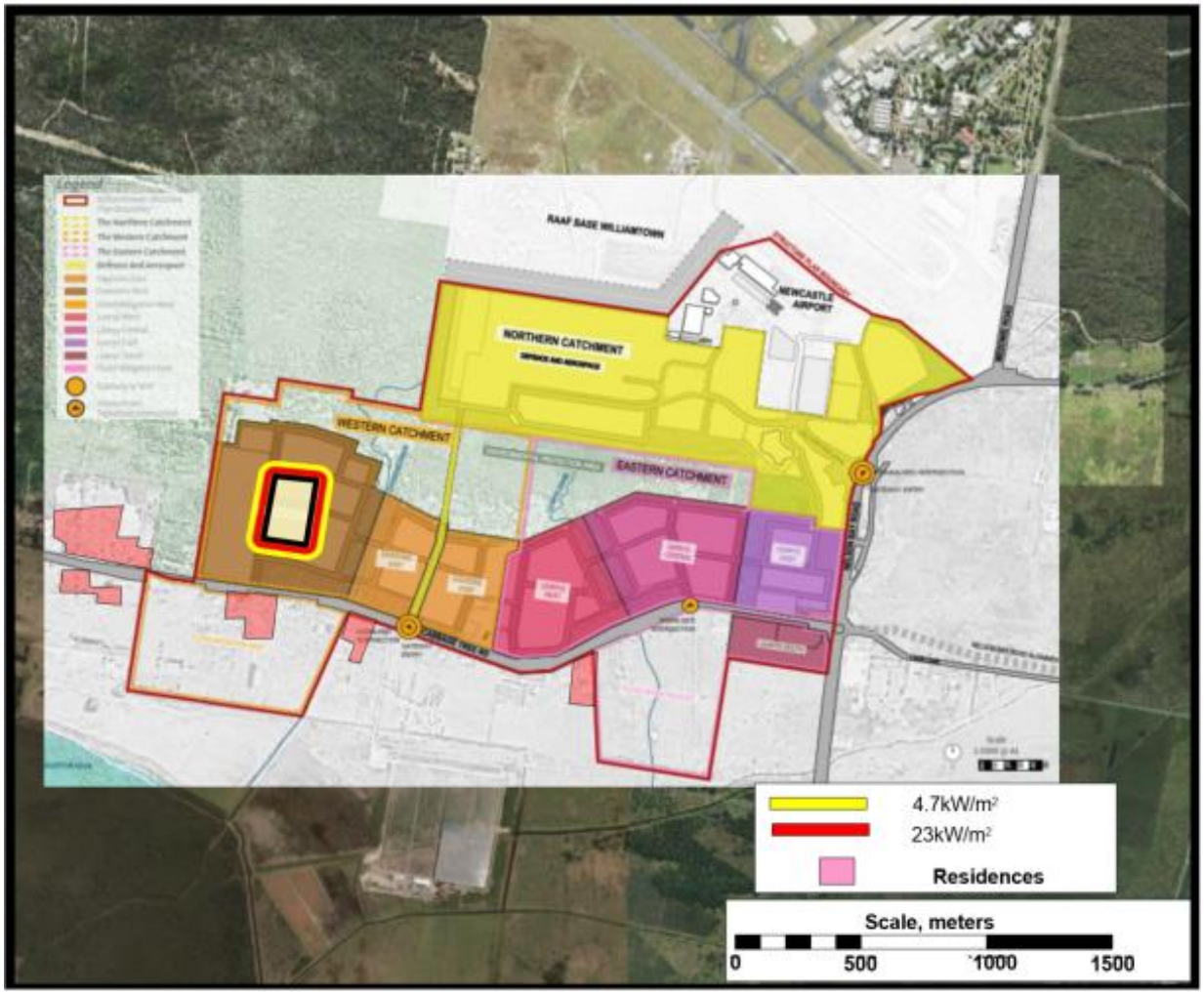
Factor for determining appropriate separation distances	Comment
What is the likelihood of the performance objective being achieved by the mitigation measures alone?	There is the potential for offsite release based on the materials on site.
What is the likelihood of the mitigation measure failing?	
What is the likelihood of an incident which will result in a failure to meet the performance objectives?	
What back up mitigation measures are available?	
What is the likely geographic extent of the impacts if mitigation measures fail or an incident occurs?	Heat radiation may extend 50m offsite to injury levels
What separation distances are required to achieve the performance objective: If mitigation measures fail or an incident occurs?	

APPENDIX B. CONSEQUENCE OVERLAYS

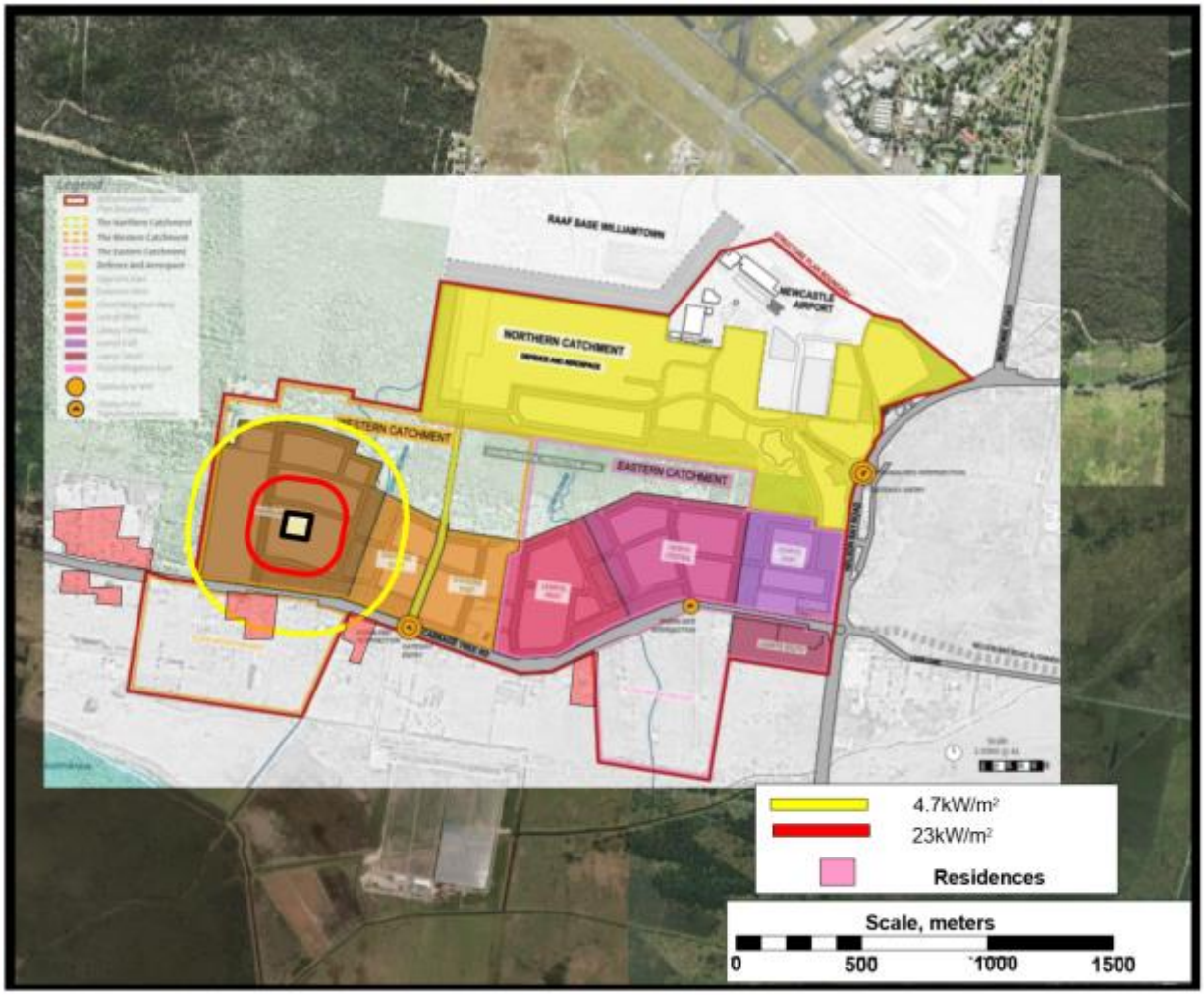
B1. Brewers and distilleries



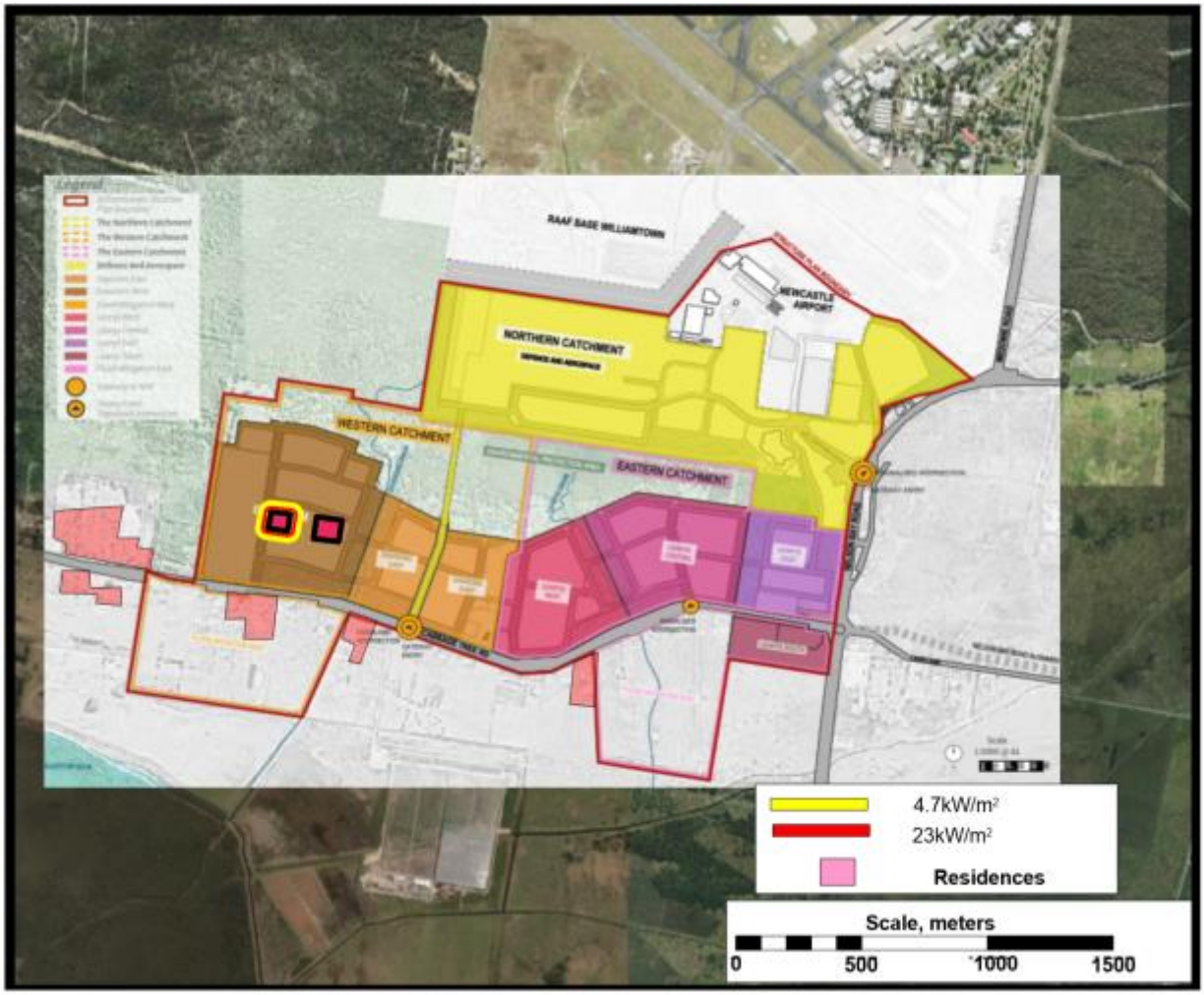
B2. Chemical industry – petroleum (bulk liquid fuel storage)



B3. Petroleum – LPG production and storage



B4. Hydrogen generation and BESS



APPENDIX C. REFERENCES

[1] NSW Department of Planning, “Hazardous Industry Planning Advisory Paper No 10 - Land Use Safety Planning,” 2011.

[2] NSW Department of Planning, “Hazardous and Offensive Development Application Guidelines - Applying SEPP 33,” 2011.

[3] NSW Department of Planning, “Hazardous Industry Planning Advisory Paper No 4 - Risk Criteria for Land Use Safety Planning,” 2011.

[4] NSW Government, Work Health and Safety Regulation 2017, 2017.

[5] Competent Authorities Pandel (CAP), “Australian Emergency Response Guide Book,” 2021.

[6] DPE, “Infrastucture SEPP,” 2007.

[7] WillyWeather, “Williamtown RAAF Base Weather Statistics,” 2020. [Online]. Available: https://wind.willyweather.com.au/nsw/hunter/williamtown.html.